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NOVEMBER, 1955

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Welding Engineer

NOVEMBER, 1955
VOL. 40—No. 11

A MAGAZINE OF JOINING AND SEVERING OF METALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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WELDING ENGINEER PUBLICATIONS, INC.
12 East Grand Avenue
Chicago 11, Illinois
Telephone: DElaware 7-0339

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MEMBER
American Welding Society
International Acetylene Association
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National Welding Supply Association
Associated Business Publications
Audit Bureau of Circulations

Single copies 50 cents. Subscription rates: United States and possessions $3 per year; $4 for two years; $5 for three years. Canada $5 per year; $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

Entered as second class matter Aug. 23, 1948, at the Post Office at Chicago, Ill., under Act of March 3, 1879. Printed in U. S. A.

WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

COVER: Like spiders on a web, these weldors helped to complete the dome on a new, giant coliseum in Charlotte, N. C. Weldors also constructed a new and finer school for this city. You will find these special features beginning on page 27 in this issue.

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NEW All Nylon Adjust-O-Lok Headgear

Nylon, lightweight and non-conductive, lends its superior, long wearing strength to every part of this completely redesigned arc welding helmet headgear.

The large, easy to handle winged knob and the gear, both of Nylon, engage a Nylon headband to give fine adjustment to head size while helmet is worn. Headband is molded in one piece with a cross strap, *now also adjustable*, over the top of the head.

The headband adjustment is entirely enclosed in a Geon sleeve, smooth fitting against the head.

Jackson Leads Way with Better Helmets

NEW Nylon Friction Pivots

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To those who prefer helmets of this popular shape, JACKSON now offers a line of helmets of the same quality as its curved and narrow shell styles, with the same new features. Made of fiber glass, strong, smooth, easy to clean, resistant to heat and moisture, *they last.*

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3	**HELMET SHELLS...**	**CURVED SHELL**	**NARROW SHELL**	**STRAIGHT SHELL**
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KEEPING up-to-date on welding methods is part of the weldor's experience. Student is here pictured learning techniques in aluminum welding and brazing. (See story below.)

RECIPIENT of Lincoln Gold Medal for an outstanding welding contribution is Nikolajs T. Bredzs. (See story below.)

News

Aluminum welding taught at Ingalls

Due to the increased use of aluminum in shipbuilding, Ingalls Shipbuilding Corp., Pascagoula, Miss., has instituted an aluminum welding course. The course is given to weldors and burners with gas-welding experience by the firm's welding department.

Three-day short courses are given in aluminum, copper-nickel and stainless steel welding. Apprentices interested in learning other welding techniques are also enrolled in the welding school as part of their overall training.

* * *

Liquid Carbonic opens CO_2 plant in Oakland

An almost completely automatic plant for the production of carbon dioxide was recently put into operation at Oakland, Calif., by Liquid Carbonic Corp., Chicago. The new facility, said to be the largest of its kind on the West Coast, requires only one production man per shift to operate the entire plant, with a second man to handle dry ice for storage purposes.

The plant, built at a cost of $1,500,000, will produce carbon dioxide in its liquid, gaseous and solid forms. Daily capacity is 50 to 60 tons.

* * *

Holiday Plastics leases headquarters

Holiday Plastics, Inc., which recently acquired the Thermacote companies of New Jersey, has leased new production headquarters at 1301 Fairfax Trafficway, Kansas City, Kans.

* * *

New firm to make welding equipment

A new corporation, Industriline, Inc., has been formed for manufacture and distribution of equipment for the welding and electrical transmission industries. General offices of the firm are at 441 Lexington Ave., New York City, with its factory in Cincinnati.

Industriline was formed by principals of Empire Products, Inc., Cincinnati, and J. B. Nottingham & Co., Inc., New York City. Officers of Industriline are J. B. Nottingham, president, Robert Senior, vice-president, and Paul Savoca, secretary.

The firm will offer cable connectors, new types of electrode holders, and strip heaters, with other products to be announced. Industriline will distribute nationally.

IIT metallurgist gets Lincoln medal

Nikolajs T. Bredzs, a research metallurgist at Armour Research Foundation of Illinois Institute of Technology, Chicago, has been awarded the Lincoln gold medal for outstanding welding contributions.

The award was given on the basis of Bredzs' paper, "Investigation of factors determining the tensile strength of brazed joints."

Bredzs, a native of Latvia, joined the Foundation as a research assistant in 1951, becoming research metallurgist in 1955. Recipient of a degree in chemical engineering from the University of Latvia, Riga, Bredzs came to the United States from Germany in 1950. He holds one patent on a brazing process and has another pending.

The Lincoln medal is donated by James F. Lincoln, chairman of the board of The Lincoln Electric Co., Cleveland. It is given each year for the one-author paper, published in the *Welding Journal*, which makes the "greatest original contribution to the use of welding."

* * *

Kaiser Aluminum to expand

Plans for expansion of five of the plants of Kaiser Aluminum & Chemical Corp., Oakland, Calif., have been completed. Major emphasis centers on the Ravenswood, W. Va., plant. Other plants are those at Halethorpe, Md., Mead and Tacoma, Wash., and Chalmette, La.

NEWS

from page 5

DISTRIBUTION branch at Kennewick, Wash., will have a complete inventory of welding supplies and equipment. (See story below.)

OVERALL view of welded all-aluminum trailer shows structural details. Trailer is lightweight yet is built for heavy use. (See story below.)

Industrial Air opens new Washington branch

Industrial Air Products Co., Portland, recently opened a new distribution branch in Kennewick, Wash. It will serve the Kennewick-Pasco-Walla Walla area. Bert Morrow has been named manager.

* * *

Linde develops new coating method

A new method of coating metal surfaces and parts has been developed by Linde Air Products Co., New York City. Termed "Flame-Plating," the new technique utilizes tungsten carbide which is shot from a gun at high pressure and temperature. Coating is accomplished by fusion of tungsten carbide particles. Although, at present, confined to tungsten carbide, the firm is currently developing other coating materials to be used in this process. (See description in New Products section.)

* * *

Ohio distributor holds welding exhibit clinic

An exhibition and clinic of welding supplies and techniques was held recently at the Youngstown Arena, Youngstown, Ohio. Guiding force behind the affair was Mahoning Valley Supply Co., of Youngstown, distributor for welding and industrial supplies. Among the exhibits was a field clinic on gas and electric welding.

* * *

NWSA welcomes new members

New active members of the National Welding Supply Association are as follows: Baltimore Oxygen Supply Co., Baltimore, Md.; Inter-City Welding Supplies, Ltd., Kitchener, Ontario, Canada; Jayhawk Welding Supply Co., Topeka; The Jimmie Jones Co., Tulsa, Okla.; Sanders & Stewart, Inc., Jackson, Mich.; Welding Service Sales, Inc., San Francisco.

New associate members are C. E. Phillips Co., Detroit; Shakespeare Glove Co., Chicago; Vacu-Blast Co., Inc., Belmont, Calif.

* * *

Chairmen chosen for Midwest Welding Conference

Chairmen have been chosen for the second annual Midwest Welding Conference to be held Feb. 1 and 2 at the Illinois Institute of Technology, Chicago.

Among the chairmen will be Ted B. Jefferson, editor and publisher of WELDING ENGINEER. Others are John J. Chyle, director of welding research, A. O. Smith Corp., Carl H. Samans, associate director, engineering research, Standard Oil Co. (Indiana); Warren McGonnagle, associate physicist, Argonne National Laboratory, Lemont, Ill.

* * *

Square D opens new Cedar Rapids, Ia., plant

With the opening of its new Cedar Rapids, Ia., plant recently, Square D Co., Detroit, took another step in its program of regional growth. This program is designed to bring Square D close to the markets it serves. When the firm's plant at Royal Oak, Mich., is completed, it will have a total of 12 plants throughout the country.

Kaiser Aluminum builds welded aluminum trailer

An all-aluminum welded flatbed truck trailer, with a 3,000 lb. increased maximum payload, has been developed by Kaiser Aluminum & Chemical Corp., Oakland, Calif. The 35-ft. trailer has a total weight of 7,986 lb. and payload of 45,000 lb.

Used in fabrication was a new aluminum alloy, 5083, high magnesium type with good weldability. A new trailer design was employed. An aluminum floor plate, extending full length of the trailer center, was an integral part of the frame.

This floor plate, outer floor plates, outrigger components, mounting pads, flanges and crossmembers—all aluminum—were welded to two main beam webs (36 in. apart) running trailer length. The trailer was Mig (metal inert-gas) welded. Fabricator was Beall Pipe & Tank Corp., Portland, Ore.

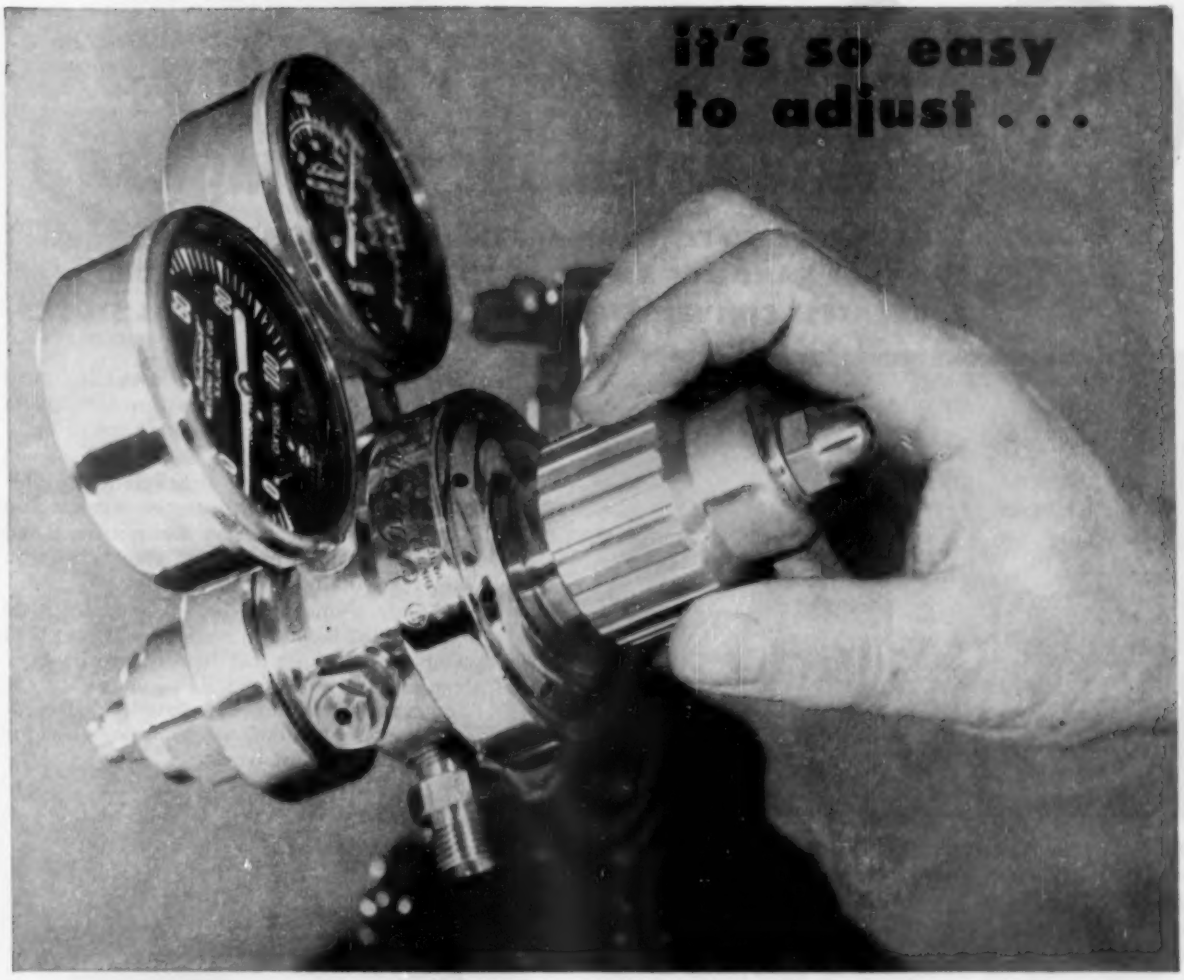
* * *

Trent Tube develops new forming process

A new welding process, for use in manufacture of welded stainless steel and high alloy tubing and pipe, has been patented by Trent Tube Co., a subsidiary of Crucible Steel Co. of America, East Troy, Wis. This new method is claimed to solve the problem of presence of weld bead on the inside diameter of the tubing after welding. It does so by taking advantage of the pull of gravity.

The technique consists, in part, of inverting the rolls of the continuous rolling mill and welding the formed tubing from the underside, thereby

(Continued on page 82)



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517

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There are single and pallet-mounted (1,000 lb., 2,000 lb., 3,000 lb.) coils, each wrapped in waterproofed paper and held secure by steel strapping; thread-wound, 25-pound reels to fit popular machines; also, coils in individual cardboard cartons, available singly or palletized for handling by fork-lift truck.

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Carbon Steel • Any carbon from Armco (.025 max.) to high carbon (.90—1.10)

Low Alloys • All the most popular welding grades

Stainless • All standard AISI grades. Other types on request

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Your welding job deserves the *right* electrodes and the *right* rods—and you can get them from the wide range offered by PAGE!

Gas Welding Rods • Armco, mild steel, low alloy, 3½% nickel, carbon or stainless steel, manganese or naval bronze

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Sizes up to 625 amps. All connectable to 220 or 440 volts — 550 volts on request.

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Capacities from 500 to 100,000 lbs. — remote-control and hand-operated models.

AC/DC WELDER
The first machine to give you either AC or DC current at the flip of a switch.

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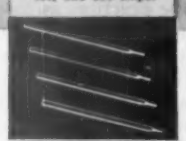
Four sizes — 200, 300, 400, and 500 amps.



ELECTRODES
For mild steel, cast iron, "hard-to-weld" steels, stainless steels, hard surfacing.

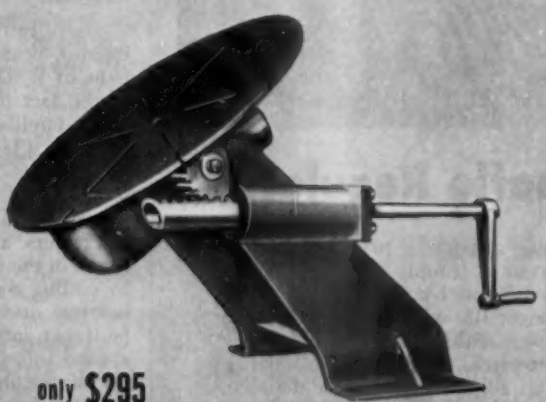
UP-1000 Welding Positioner

A light touch of the hand is all it takes to position weldments up to 1000 pounds positively and quickly with the P&H UP-1000. The welder simply clamps the work piece to the table and adjusts spring tension with the crank. An exclusive feature then keeps the unit in static balance, regardless of whether the piece is rotated through a full 360° or moved horizontally or vertically.

With a light push, the welder guides the piece to the precise angle he wants as the work progresses for economical downhand welding all the way through.

The P&H UP-1000 occupies a floor space of just 22" x 25" and weighs only 200 pounds.

only $395



only $295

WP-1 Welding Positioner

Here's P&H quality in a low-priced, work-hungry positioner that handles weldments up to 500 pounds. Ideal for floor or bench mounting. Gives you full 360° table rotation. Advanced design permits the 20" diameter table to tilt 135° from horizontal without weldment striking the positioner — makes it a cinch to reach ordinarily troublesome places. Tilting crank has spring-lock indexing — you set it and it stays.

Electronically-controlled, motor-driven turntable also available — to provide stepped up production.

Manual unit easily portable — weighs only 100 pounds. Stands 15⅞" high with table in horizontal position. Optional equipment includes pedestal for floor mounting at slight additional charge.

P&H Announces the UP-1000 and WP-1

Two new P&H Welding Positioners so reasonably priced that no plant can afford to be without them

Now, with these two new P&H units, economical downhand welding is within the range of every small plant or department. And for the first time, low-cost, positioned work is practical, even on the smallest weldments.

With these two units, you consistently turn out better, faster, lower-cost work because you weld straight through in the downhand position. You end wasted motion, constant repositioning of the piece. You use larger, hotter electrodes to deposit metal up to *twice as fast*. And you make stronger, better-looking welds, too — welds that help add sales appeal to your product.

Whatever you weld, you're ahead with one or both of these low-priced P&H cost-cutters. Put them to work for you and watch productivity increase, costs drop. Order now from your nearby P&H distributor or write P&H Welding Division, Harnischfeger Corporation, 4513 W. National Avenue, Milwaukee 46, Wisconsin.

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the P&H *Line*

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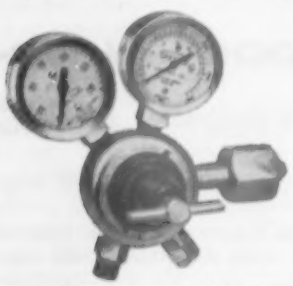

Functional parts reduced by 25%

That means less wear, less maintenance, less time to adjust and operate. These Regulators are built to stay on the job. They let you forget about regulation and concentrate on your work. Special sintered bronze filter protects mechanism against wear from dirt and dust.

New seat stands high temperatures

You can say goodbye to delays from burned out seats. New seat material used in Smith's Econoflo Regulators will withstand temperatures that ignite ordinary seat materials. And, they are impervious to gas and acid reactions.

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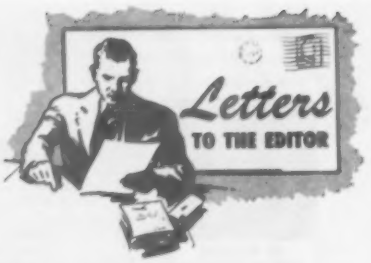

Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if you request.

Standards for weldments

Dear Sir:

I have just read, with considerable interest, your editorial in the August issue of WELDING ENGINEER. Because of the fact that you are striking so many familiar chords, I decided to drop you a few lines, to emphasize my appreciation for recognizing an important need.

Just as you say, small and large fabricators are handicapping themselves in their attempt to obtain work by cutting corners in following engineering drawings, which may lack pertinent information necessary for a good job, just because the originator of the drawings is not familiar with the fabrication of weldings.

In the welding industry we often find some of the practices as they exist in the building industry. Insufficient information about drawings or specifications is expected to be made up for by the know-how of fabricators. This works if they are sincere and intent upon furnishing a weldment of the right quality.

What is the right quality? It varies so much that a line simply cannot be drawn. I remember several cases in which (prior to our attempts to accomplish some sort of standardization) bidders were receiving orders for complicated weldments composed of plates as thick as 3 and 4 in.

Because of the cut-throating among themselves, these bidders ended shipping fabricated assemblies that lacked everything but the general shape.

It was at this time we decided to bring unity to the situation through standardizing terms and meanings which could not be twisted.

We drew up what we call "Arc welding specifications based on accessibility and metal thickness." It gives certain information to our designers and describes a number of the joints generally used by us.

These specifications, as well as oth-

ers which might pertain to low-temperature stress-relieving or high-temperature normalizing, together with pertinent notes appearing on our engineering drawings, are made available to every vendor, in order to eliminate many misunderstandings.

The quality of our parts has steadily improved since the introduction of this data. It apparently has forced would-be bidders to quote within the range of the specifications. Of course, just as you say, prices given by certain vendors went considerably higher; others were not affected at all.

Your proposals for establishing classes—differentiating the types of welds, edge preparations, penetration, etc., etc.—certainly are a step in the right direction. There is no reason why some order cannot be brought to the chaos of opinions present in the minds of those who are willing, but are not able, or those who are able, but look for a cheap way of getting a job.

It should not be up to persons outside of the welding industry to have to establish standards. This should be the responsibility of those who use it to make a living.

E. J. Opitz
Fisher Body Div., GMC

* * *

Supports NWSA index

Dear Sir:

I have just read the Mid-June Fact File issue of your publication. I want to compliment you for the cooperation and interest you have taken in using NWSA's index as a standard for your reference issue.

With your continued support and NWSA's educational meetings, we will undoubtedly have a majority of the manufacturers following these standards soon.

James N. Alcock
Saginaw Welding Supply Co.

* * *

Tig welding and CO_2

Dear Sir:

I would like to obtain a copy of the article "Tig welding with a CO_2 shield" by Edward J. Vogel and D. F. Zimmerman. It appeared in WELDING ENGINEER, June, 1955, page 28.

Leonard J. Synk
Maple Heights, Ohio

—Tear sheets of the article have been sent to Mr. Synk.

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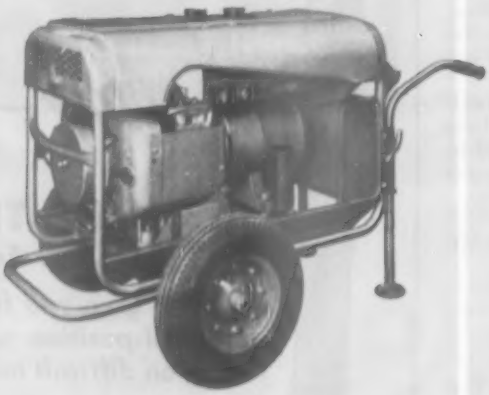

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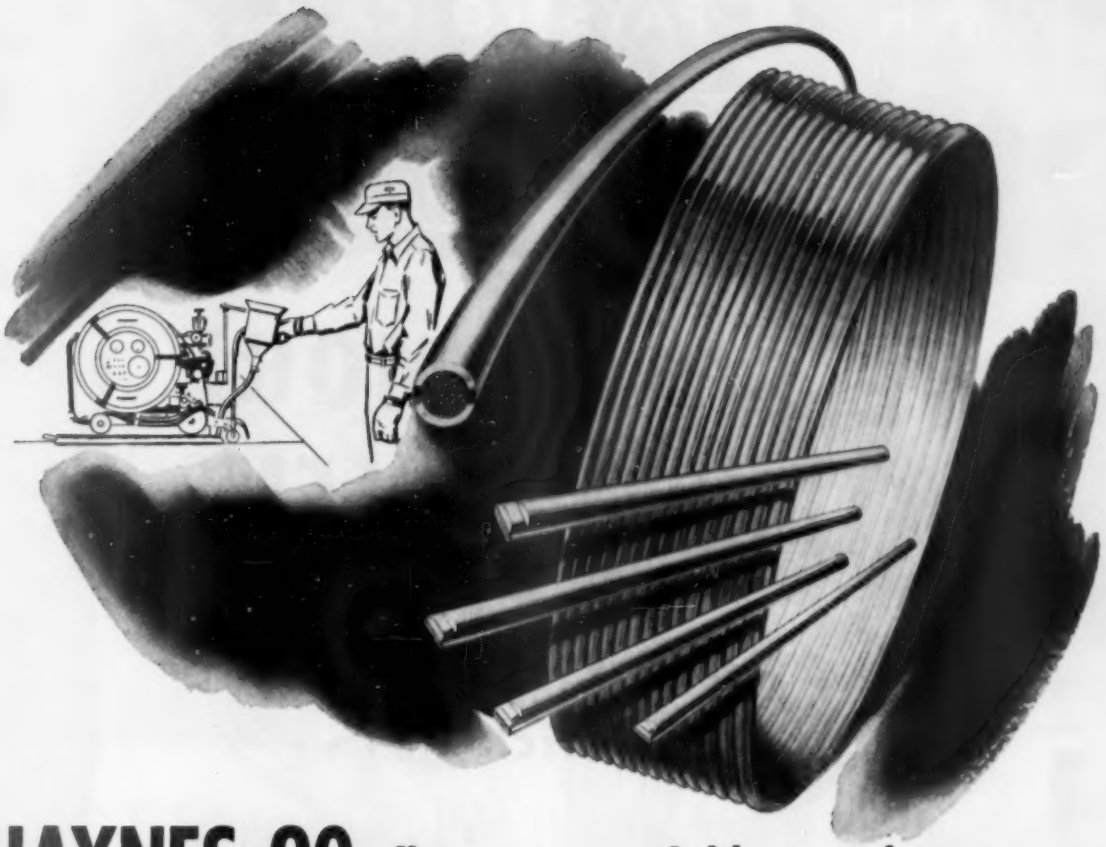

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TRADE-MARK

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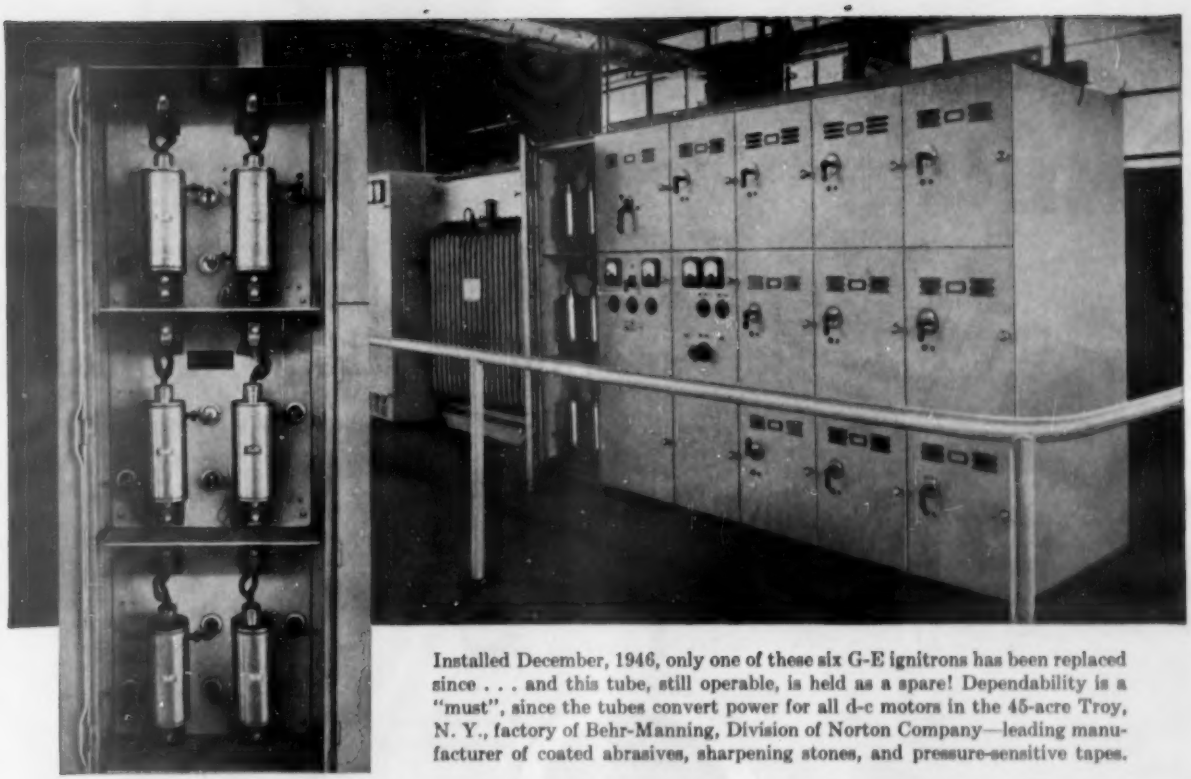

Installed December, 1946, only one of these six G-E ignitrons has been replaced since . . . and this tube, still operable, is held as a spare! Dependability is a "must", since the tubes convert power for all d-c motors in the 45-acre Troy, N. Y., factory of Behr-Manning, Division of Norton Company—leading manufacturer of coated abrasives, sharpening stones, and pressure-sensitive tapes.

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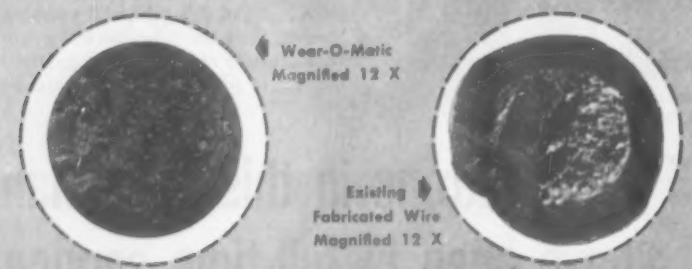

These cross sectional views of fabricated wire were made under identical conditions. Notice the compactness and perfect roundness of Wear-O-Matic precision drawn wire as compared to existing fabricated wire. This dense, controlled diameter wire provides the smooth feeding and excellent arc characteristics of solid welding wire and insures a weld deposit that is uniform in soundness, chemistry and hardness.

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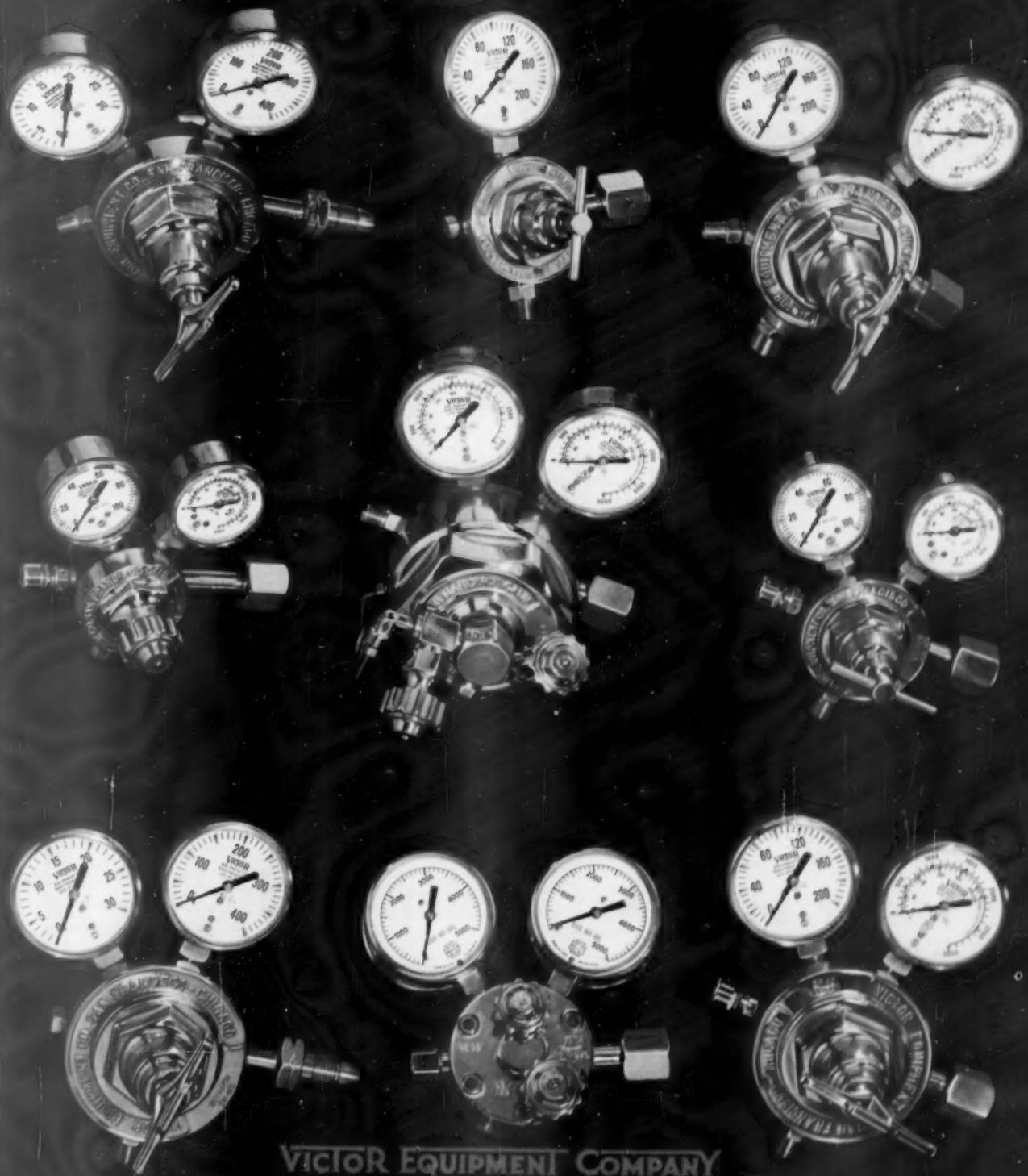

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Thanksgiving with reason

NOVEMBER: football games . . . duck shooting . . . Thanksgiving . . . turkey. November brings a variety of thoughts to mind, and most of them end in Thanksgiving.

Like most holidays, Thanksgiving has lost its original meaning to many Americans. It would be interesting to see the answers that might be obtained from a sidewalk survey on the question, "Why do we have a national holiday called Thanksgiving?" All of us on WELDING ENGINEER know why, and we have many things for which we are thankful.

We are especially thankful for our many friends among our subscribers and advertisers for the support they have given us and our new organization. We are equally thankful that we have been able to serve so many in the welding industry. In some instances, we have been able to serve better because of suggestions from our readers. We are thankful that our readers are interested enough in WELDING ENGINEER to offer suggestions that improve our ability to serve. Criticism is equally welcome for it is through comments, unfavorable as well as favorable, that we learn more about the job we are doing.

One of the newer services of WELDING ENGINEER has been the inclusion in its news column of a calendar of coming events of interest to those engaged in the joining and severing of metals. This feature, which first appeared in the August issue of WELDING ENGINEER, is a listing of important meeting dates for the coming year. It has proved a welcome addition to the long list of services performed by WELDING ENGINEER. We can be helped further on this feature if our readers will alert us to events of wide interst.

SINCE 1946, WELDING ENGINEER has been providing its subscribers with a bonus issue each year, the Fact File issue of WELDING ENGINEER. A few short months ago, all regular subscribers received the 13th Fact File issue. We feel that this is a valuable supplement to the regular issues of our magazine. Many of our readers have confirmed this thinking but we would like to learn how many more people feel about the Fact File issue.

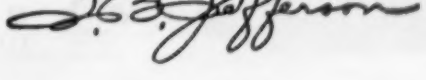
Last month, by means of a card bound in the October issue, we asked our readers for their comments and criticisms on the Fact File issue. While some cards have already been returned, we hope to get many more. Through them, it will be possible for us to make the Fact File issue more to everyone's liking. Similar comments on our regular issue will be valuable in improving them, also.

WE have many things to be thankful for. Within two months, WELDING ENGINEER will be celebrating the completion of 40 years of service to those engaged in the joining and severing of metals. We have been asked what we are doing to commemorate our 40th anniversary. What more can we do but carry out our dedicated policy of service to readers and advertisers? This has been our aim throughout the past and seems to be a worthy goal for the future.

Speaking of the future, from all indications it holds many things for which we can all be thankful. 1955 appears to be a year that will break records in all fields where welding and cutting are concerned. In the construction industry it appears that nearly $42 billion will be spent, exceeding a record-breaking 1954 by 10%.

In another part of this issue we talk about welded homes. For twenty years, family formations in this country exceeded housing starts. If we were to start today and build 350,000 replacement homes a year, it would take 150 years to replace the nation's present housing. This year will see nearly 8,000,000 automobiles built, and predictions tell us we'll produce another 8,000,000 next year.

In summing up all the advantages that have been gained throughout a very good business year, it is easy to see that we all have something to be thankful for. But perhaps our greatest blessing lies in the fact that we live in a country where we receive benefits for which we *can* be thankful.



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RESISTANCE WELDING:

Making fan guards easier and faster

BY JACK FAIRLIE

IN a spacious, well-equipped factory on Chicago's Northwest side, 300 employees of Berns Manufacturing Co. produce a complete line of "Air King" fans. These fans presently are distributed throughout the United States, Canada and South America.

SPOT welds play an important part in the fabrication of the fan frame.

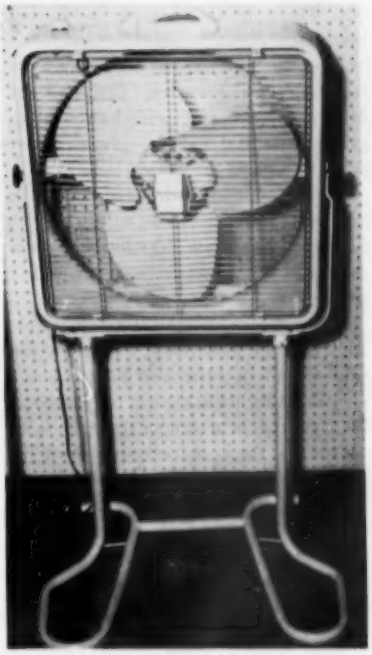
Fabrication of the fans, which include square and circular floor, table and wall models, has been simplified through the application of resistance welding processes.

Two large projection welders, a 100 kva, single-phase unit with a 100% duty cycle, and a 150 kva, single-phase unit with a 60% duty cycle, are the major manufacturing components in Berns' welding assembly line.

Through them go aluminum fan-guard grid assemblies at a rate of from 700 to 1,400 in an eight-hour work day. This volume is dependent upon grid size, and whether or not the grid must be "flopped" for an additional welding application.

L. C. Anderson, chief engineer at Berns Co., praised the efficiency of the resistance welders, and pointed out that the larger unit had performed almost daily for a year with no mechanical breakdown.

"Maintenance has been no real problem for us," he stated, "and should either machine break down, we expect it will be the small firing tube controlling the arc, and not the ignitron or thyratron."

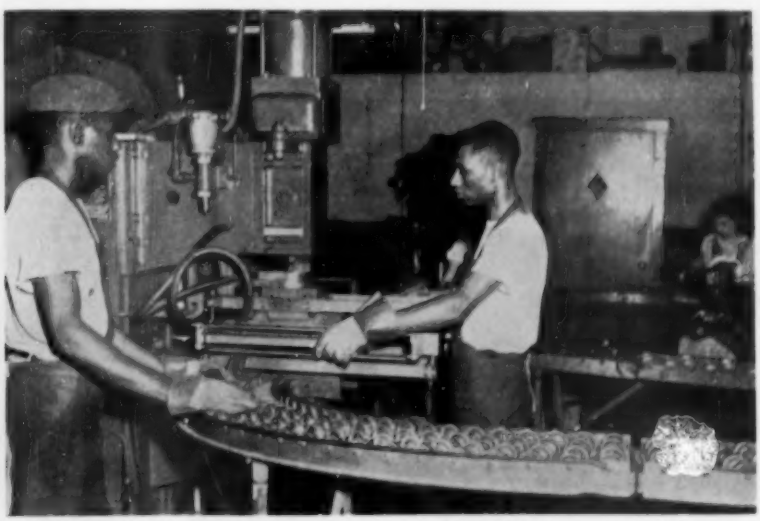


ROLLER stand for large fan models is made of steel tubing fabricated by Mig welding, brazing and silver-soldering.

Effect of Tube Failure

Mr. Anderson said that a tube that has expended its service life will not affect the welder's duty cycle at any time before failing. "When it has run its course," he said, "it simply blows

TOP and bottom electrodes for resistance welder handling grids are each 11½ in. long.



PROJECTION welder can turn out from 700 to 1,400 fan-guard grids every eight hours, depending upon number of welding applications. (Operators removed goggles for this posed photo.)

out. There is no apparent period of weakening."

The jig used in the largest of the resistance welders was designed by Mr. Anderson. It will handle two grid sizes, and can be given minor adjustments in an hour's time.

Mr. Anderson admitted that the cost and complexity of building some extremely accurate jigs led the company to omit a few resistance welding procedures in favor of riveting.

The problem of joining the different types of light metals used in the fabrication of fans also played some part in the substitution of riveting for welding in a few instances.

On the Berns production line, in addition to the large units mentioned, there are 15 resistance welders presently in operation. These machines, which vary from 7½ to a 75 kva unit, are used in spot welding certain portions of the fan frame.

WOMEN lend a deft hand on fan-guard grid assembly line. Here they quickly roll aluminum wire sections into a form which is then locked in jig for projection welding process.

Spot-Welded Fans

The largest of the square, flush-installed wall fans in the Berns line has a spot-welded inner frame on which the motor is mounted. Smaller, circular wall fans are fabricated almost entirely with spot welding.

The "AV" series of fans has a grid guard that is curved after welding. Grids for smaller models in this series can be welded five at a time in a specially-built jig before the curving process.

Gas and arc welding processes, as well as brazing and silver soldering, are also used at Berns. Three of these joining methods are employed in the fabrication of a roller stand for two of the larger models in the "RA" series. The steel tubing is Mig (metal inert-gas) welded, brazed and silver-soldered.

Arc welding is used in limited areas on the frames for some fan models—usually where the metal must be joined at a 90-deg angle with no overlapping. An E6013 electrode is used almost exclusively with a straight polarity machine setting in this application.

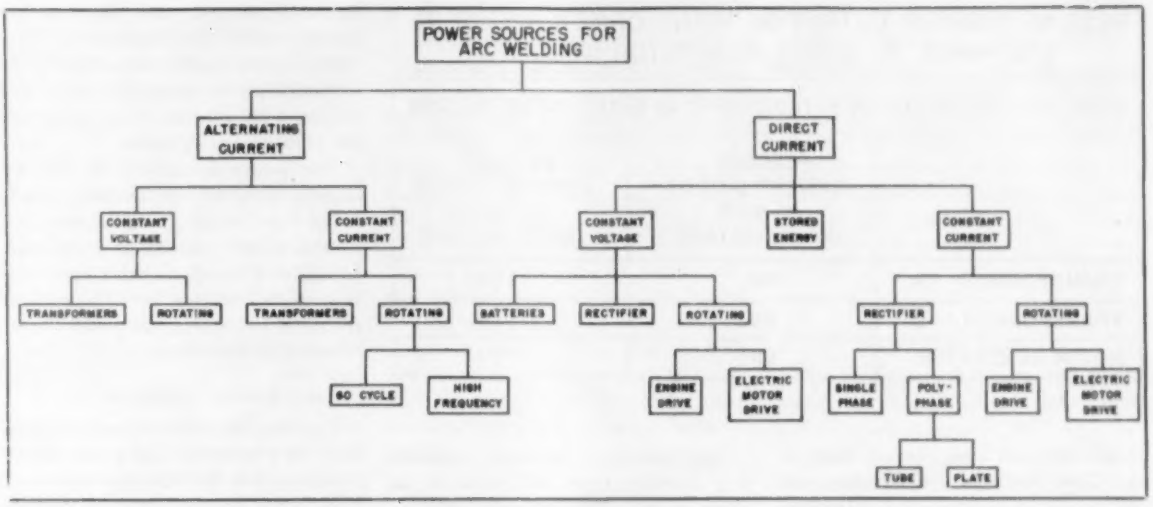
Before switching from bolts and rivets to resistance welding for fabrication, Berns subjected a group of welded fans to unusually severe tests.

"Portable fans generally receive a great deal of abuse while being moved from place to place," said Mr. Anderson. "Our fans had to have the strength and flexibility to withstand a 5-ft drop the one minute, and a kick in the grids the next."

Resistance welding, obviously, filled the bill for Berns Manufacturing Co. which, in September, began designing a new line of fans for 1956, and laying plans for improved uses of resistance welding in production.

BRAZING is one of three joining applications used in the fabrication of roller stands for large fan models. Mig welding and silver soldering are used also on steel tubing.

ARC welding seals flush corners of frame for large wall fan. This is one of a few fabrication steps calling for joining processes other than resistance welding.



Three welder types are compared to determine the best . . .

Arc welding power sources

JOHN H. BLANKENBUEHLER*

THE American Welding Society *Handbook* states that arc welding includes a group of welding processes wherein coalescence is produced by heating with an electric arc or arcs.

Arc welding processes may be divided into those in which arc voltage is held approximately constant by feeding the electrode at a suitable rate to correct deviations in arc voltage, and those in which there is no change in electrode feed to maintain constant arc voltage.

It can be seen that the first category will cover all non-consumable electrode processes, and all consumable electrode processes in which the electrode is fed to the arc by a means which uses the arc voltage to control wire feed.

All processes using automatic or manual wire feed to maintain a constant arc voltage will require a power source of the constant-current type.

The term "constant current" is used rather loosely, since the equipment does not really provide a constant current to the arc. By a constant-current power source, we mean a power unit providing a drooping characteristic in which the voltage decreases as the current increases.

*Design engineer, Hobart Bros. Co., Troy, Ohio.

Necessary Characteristics

This power source must have proper transient characteristics and fast voltage recovery if it is to maintain the arc with good stability. Of course, it should be lightweight and small in size; it should have a high-efficiency, high-power factor, low no-load input, low noise and windage, a very wide current adjustment range, and long life.

Although this power source can be the conventional d-c rotating machine driven by an electric motor or gasoline engine, it can also be one of the many types of a-c transformers or the rectifiers. For purposes of simplification, we will not consider the rotating a-c, constant-current power supplies, or the single-phase or tube-type rectifiers.

The simplest way to decide on power sources for voltage-controlled arc welding is to take the above characteristics one by one, and consider the three-phase, plate-type rectifier, the single-phase a-c transformer, and the d-c motor-generator set in connection with each of these qualities.

Probably the most important characteristic of a welder for controlled-arc voltage operation is its general usability with all kinds of welding electrodes, in all positions and for all kinds of materials. There is little doubt that the d-c apparatus excels its a-c counterpart in this respect.

It is also probable that arc characteristics of the motor-generator set can be adjusted to suit a greater variety of welding conditions than the rectifiers.

Considering current range over which arc current may be adjusted for a welding power source of given size, transformers and MG sets probably excel rectifiers.

Rating Problems

In the present state of rectifier development, because of low heat storageability of rectifier plates, it is manifestly impossible to put a rectifier plate assembly in a unit rated for the name-plate rating of the machine, and one which also will carry a heavy overload satisfactorily.

Rectifier plates are therefore actually rated for maximum output of the rectifier welder, which usually is slightly over the NEMA specified maximum of 125% of name-plate rating.

One characteristic of the rectifier welder is the inherent rise in plate

WELDING CURRENT OUTPUT OF TRANSFORMER WELDERS COMPARED TO MOTOR GENERATOR WELDERS		
EACH UNIT ADJUSTED FOR RATED OUTPUT AT RATED INPUT VOLTAGE		
	PERCENT CURRENT OUTPUT AT 90% INPUT VOLTAGE	PERCENT CURRENT OUTPUT AT 110% INPUT VOLTAGE
TRANSFORMER A	82.	112.
TRANSFORMER B	85.	114.
MOTOR GENERATOR	99.	101.

resistance with age, whether used or not. This results in a steady decrease in maximum output, and increased heating of rectifier plates at a given load.

If a welding power source of low noise and windage is desired, the obvious type would be a naturally ventilated transformer welder with no fan. These types have nearly been forced from the market, since they cost much more to build than one with a fan.

Even with this type of transformer, noise can occur if the mechanical assembly is not properly made or is not rugged enough to stand the alternating current forces involved. Rating available machines on the basis of relative quietness would put them in this order: transformers without fans, transformers with fans, rectifiers, and MG sets.

Size Considerations

Considering physical size, the silicon-insulated transformer gives us the smallest piece of equipment. But the surfaces of any device using internal temperatures permitted by silicon insulation are apt to be somewhat warm.

The conventional transformer is smaller than the rectifier, and the rectifier generally occupies less floor space than the motor-generator set. The weights of all these units run in about the same order as their size, with transformers the lightest and MG sets the heaviest.

Efficiency of transformers is much better than that of rectifiers or MG sets. Transformer efficiency will run about 80 to 90%, whereas the efficiency of a rectifier will run 60 to 70%, and an MG set will run 55 to 65%. Note that all of these efficiencies are at rated load and voltage.

Approximately the same relationship between types will hold at all other loads. Although efficiency is often given an important place in sales arguments, it actually is not too important in the over-all selection of welding equipment.

One feature of power cost, along with loaded efficiency of welding equipment, is the no-load input. Most welding equipment sits idle and energized for a greater part of each day. Most of our studies have indicated that the average welding set is loaded less than 25% of the time. Consequently, any power used by the equipment when running at no-load is wasted.

No-Load Input

Here again, the no-load input of various types of power sources will run in the same general order as their efficiency. Naturally, ventilated transformers will give minimum no-load input; fan-ventilated transformer, the next lowest; the rectifier is next, and the MG set probably will give the highest no-load input.

It is always possible to distort information about no-load input as well as efficiency, because in most welding equipment, both depend on control settings.

It is possible to reduce the no-load input of an MG set by reducing to a minimum value the excitation to the shunt field of the generator. Similarly, it is possible to reduce the no-load input of saturated-reactor-controlled transformers and rectifiers by reducing excitation of d-c control coils to a minimum value.

One important advantage of the motor-generator set and rectifier over the transformer is the fact that balanced power is taken from a three-phase line. The transformer takes its power from only one phase of the power supply. The installation of too many transformers with improperly arranged phase connections can be a nuisance to the power company or the plant power system.

The power factor of the MG set slightly exceeds the rectifier power factor at working loads and, of course, greatly exceeds it at no-load. In almost all cases, no extra apparatus is provided with either MG sets or rectifiers to correct the power factor inherent in their designs.

Power Factor Correction

Synchronous motor - generator sets have been made for bad power factor locations, but they are not common. The poorer power factor of the rectifier at no-load is somewhat offset by the smaller no-load input of this equipment.

The transformer welder is generally supplied with capacitors for power factor correction and, when so equipment types for the weldor, but under loads. At no-load, it will have a leading power-factor correcting ability.

In some cases where there are many transformer welders, the extraordinary amount of power factor correction available has been excessive and has proven just as bad as too low a power factor. Of course, this is easily solved by disconnecting some capacitors in these welders.

The motor - generator set probably can be made the safest of various equipment types for the weldor, but the rectifier as produced is practically as safe as the MG set. It is generally recognized that the transformer welder is not as safe for the operator as the d-c welder.

Motor-generator sets and transformers have been on the market for many years. The rectifier is so new that it is impossible to say exactly how its life will compare with that of the other units.

Pros and Cons

The welding motor-generator set and the transformer will last for many years as rugged, low maintenance apparatus. Claims that the rectifier will require less maintenance than the MG set have not yet been proved.

Rectifier welders have as many parts in them subject to failure and in need of maintenance as the MG sets. The only possible advantage

is that most of these parts are not moving. We believe the rectifier is somewhat more susceptible to extraordinarily high temperatures, corrosive atmospheres and dirt than the transformer or MG set.

Plate manufacturers estimate a plate life of 10,000 hours. If this is the average life of rectifiers, it indicates they will not last more than one-third or one-fourth as long as transformers or motor generator sets.

Transient and voltage-recovery characteristics of the modern rectifier, transformer and MG sets are completely adequate. The transformer, of course, requires the use of a-c electrodes which, in many cases, cost a little more per pound than d-c electrodes.

There has been some attempt in the design of rectifier welders to provide extra gadgets giving transient characteristics similar to those of the MG set. These gadgets, in general, add to the arc current if arc voltage falls below a specified value.

When the arc is short-circuited, a current surge results similar to that which occurs with an MG set. An MG set gives a current surge proportional to the current being used. With a rectifier arc-booster circuit, the amount of current surge is generally the same, but sometimes adjustable.

In some cases, the rectifier welder does not give an even d-c output. The control system used often results in a very large ripple in output current, with minimum current sometimes as low as one-third the average current. Ripples of this caliber present arc stability problems.

Magnetic Blow Reduction

It is sometimes claimed that this ripple reduces magnetic blow at the arc. Elimination of magnetic blow is one of the very desirable characteristics of the a-c transformer welder. Our tests have indicated that there might be some reduction in magnetic blow with the rectifier, but certainly not to the extent to which a transformer reduces it.

Unfortunately, our tests have not been quantitative, and are only the result of an operator's opinion. This rectifier output, which is not an even direct current, will result in differing ammeter readings depending upon the instrument type. With conventional instruments, a rectifier may have to be adjusted to a different current to get the same burn-off rate as an MG set.

Claims that the output of the rectifier welder will not change with a temperature rise as the machine warms with use are incorrect. A rectifier welder will drop about 7 to 10% in output current when loaded at the continuous equivalent of its 60% duty cycle rating.

Here again, amount of drop will depend upon the type of welder output control and whether excitation coils are operating at maximum or minimum value. This drop-off with the rectifier welder is certainly less than usual MG set which, under similar conditions, will drop off from 10 to 15%.

Power for Automatic Welders

In addition to controlled arc voltage processes, there are continuous consumable electrode processes. These used to be the controlled-arc voltage type, but now may best be described as constant electrode feed type with constant-voltage power supply.

Development of the constant-voltage d-c power supply for automatic welding processes has greatly simplified the required control apparatus. Of course, the motor feeding wire to the arc must have an adjustment allowing speed to be changed for different applications.

This process works out very simply and reduces installations and set-up time on various jobs to an astonishing minimum. For some unexplained reason, it also seems to give higher welding speeds.

With constant voltage across the arc from the supply generator, and with a constant wire-feed speed, any slight increase in arc voltage results in an instantaneous and drastic reduction of welding current. This, of course, immediately acts to correct arc voltage.

Similarly, a decrease in arc voltage immediately results in such an increase in welding current that it melts the wire back to the correct arc voltage almost instantaneously. When the arc is started, current delivered to the arc is so great it burns the wire back to the proper arc voltage instantly.

Constant Voltage Types

Arc starting, therefore, is automatic and sure. There is little doubt but that all automatic welding processes will be of the constant-voltage power supply type in the future.

Constant-voltage power supply comes in various types, and it can be made as a rectifier or as an MG set. With the rectifier, it is necessary to accept a slight droop in voltage with increased welding current. But with the MG set, it is possible to get constant or even rising voltage characteristics.

Although constant current and constant voltage constitute the great majority of arc welding power sources used, there are other types. For instance, on a job away from commercial power sources where there are a number of welding arcs, it is becoming desirable to install a large 50 to 100-kw Diesel engine generating set.

This will supply either transformer, rectifier or single-operator MG welding sets. The large Diesel engine generator set could be considered a power source for arc welding.

In the case of stud welding, some unusual power sources are sometimes used. There is a manner of stud welding in which a large capacitor is

WELDING CURRENT OUTPUT OF RECTIFIER WELDERS COMPARED TO MOTOR GENERATOR WELDERS

EACH UNIT ADJUSTED FOR RATED OUTPUT AT RATED INPUT VOLTAGE

	PERCENT CURRENT OUTPUT AT 90% INPUT VOLTAGE	PERCENT CURRENT OUTPUT AT 110% INPUT VOLTAGE
RECTIFIER A	77	130
RECTIFIER B	77	130
RECTIFIER C	75	138
MOTOR GENERATOR	99	101

300 AMPERE, 40 VOLT, 60% DUTY CYCLE WELDING SETS	CONSTANT CURRENT TYPE OF POWER SOURCE		
AVERAGE CHARACTERISTICS	TRANSFORMER	RECTIFIER	M.G. SET
WEIGHT - POUNDS	427.	573.	765.
FLOOR AREA - SQ. FT.	3.75	4.40	5.47
VOLUME - CU. FT.	12.8	16.7	12.8
EFFICIENCY - RATED LOAD	84.	64.	60.
POWER FACTOR - RATED LOAD	77.	80.	87.
NO LOAD INPUT - WATTS	576.	1060.	2850
NOISE	LOW	LOW	HIGH
MAXIMUM OUTPUT - PERCENT	140.	138.	153.
SAFETY	FAIR	GOOD	BEST
ELECTRODE VARIETY	LEAST	GOOD	GOOD
ELECTRODE COST	PREMIUM	STANDARD	STANDARD
CURRENT CHANGE WITH INPUT VOLTAGE	LARGE	MOST	LEAST
CURRENT CHANGE WITH WARM UP	LEAST	LOW	MOST
ARC BLOW	LOW	MODERATE	HIGH

charged by a small MG set during the time between welds. The capacitor is then discharged through a reduced section area of the stud to melt down this section and weld it to the plate.

Also for stud welding, storage batteries occasionally are used as a power source. Stud welding requires a lot of power for a very short time. Since the duty cycle is therefore very small, stored energy systems such as the storage battery and capacitor have come into use for this welding process.

Another way of storing energy between welds is to use a high-speed, flywheel MG set. The motor stores energy in the flywheel between welds and the generator uses this energy at the time of the weld.

Low Generating Capacity

This results in a somewhat smaller motor generator set than would be required if the conventional type of set was used. It also eliminates the maintenance problem associated with storage batteries.

The constant potential, d-c motor generator set also has been used extensively in installations where there is a high density of welding operators, such as in shipyards. In applications of this type, a resistor panel is used to provide each operator with a "constant current" characteristic.

The weldor adjusts his individual current by adjusting resistance in his individual welding resistor panel. This system resulted in a surprisingly low generating capacity for a considerable number of arc welders.

Many shipyards have entirely adequate installations of constant-voltage motor generator sets feeding arcs through resistor panels where each weldor has available to him as much as 300 amp if desired, but where generator rating is only as high as 30 amp per arc.

This apparent discrepancy is justified by the fact that the weldor seldom wants the maximum current available to him, and he also is welding only a very small portion of the total time.

Sets of this type generally were made at a 1,500-amp rating at 70 volts. As many as 12 of them were paralleled to make one large power source for one or two shipways. In general, this system has been popular only with seaside shipyards. It did result in a very reliable, low maintenance welding system.

Safest of All

It presented the problem of fixed polarity (i.e., the weldor could not reverse his polarity at will) and it required large copper conductors running throughout the yards. It was, without question, the safest installation of all.

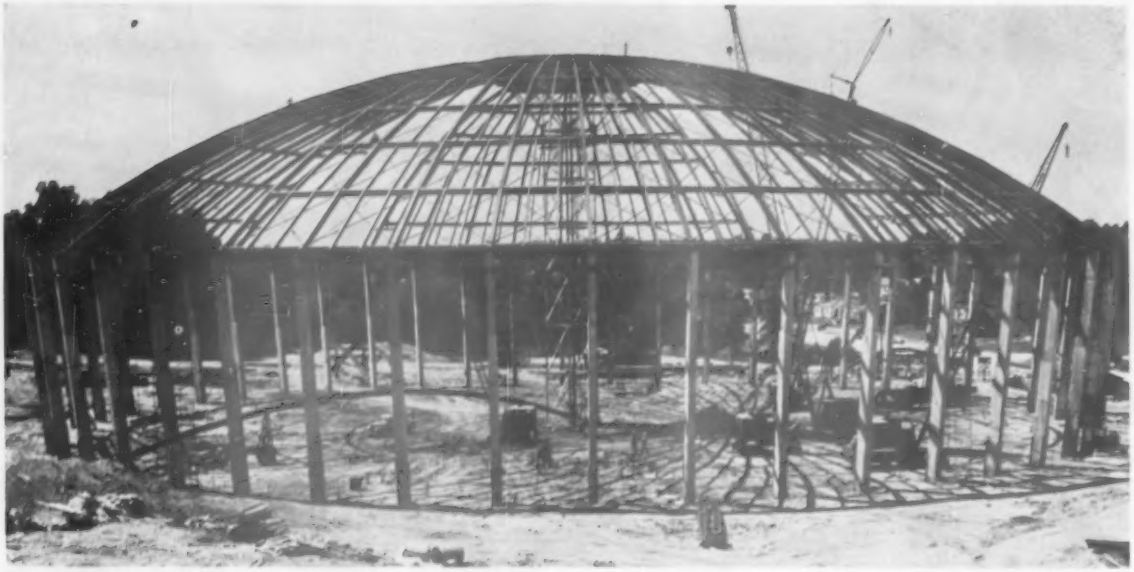
Motors for sets of this size could be made for high input voltages, and occasionally made it possible to eliminate step-down transformers from the central station power supply.

Many of the features advertised as "excellent qualities" of certain equipment types are not nearly as important as the one big feature which might be called "weldor's satisfaction."

Procure for your weldor a machine that will do all the things he wants it to do in the best possible manner. You will be saving more money in providing him with this machine even if it doesn't possess the highest efficiency, the best power factor, or many other widely discussed qualities.

WELDOR and helper are mere dots against the sky while working on connecting rib of coliseum dome. Used in construction were 6,000 ft of welding cable and 16 welders.

As a special feature of this issue, WELDING ENGINEER takes you on a quick trip to Charlotte, N. C., where welding reportedly is gaining wide acceptance in the construction field. Author William E. Wolff, advertising manager of the National Welders Supply Co. of Charlotte, conducts this informative "tour" on the following four pages.



COLISEUM frame, said to be the largest structural steel dome in the world, nears completion. Approximately 21 tons of electrodes were used on the job.

Coliseum is a welded giant

WELDED construction in Charlotte, N. C., has been given a recent boost by the giant municipal coliseum just completed there. Designed as a huge sports arena and entertainment center, the building's structural steel dome is the largest of its kind in the world. It is 332 ft in diameter and tall enough to hold a ten-story building under its roof.

A. G. Odell, Jr., and Associates, architects for the project, decided on a circular design because this shape permits a maximum area within a minimum of perimeter wall. It also allows spectators to be seated on all sides of the performing area, and provides for free circulation of air.

The round design lends itself well to cantilever construction, giving an unobstructed view to the 13,500 persons who can be seated in the building.

In addition to these outstanding features, the coliseum presents an interesting example of structural welding. There are 2,664 major welded connections in the roof alone.

Erection of the all-welded structure required the use of 12 tons of electrodes at the building site. Another 9 tons were used in shop fabrication. Electrodes used throughout the job were E6010's.

The first step in building this unique structure was the pouring of 48 reinforced concrete columns evenly spaced around the perimeter wall. These columns, each 53 ft high, support the entire weight of the large inverted bowl which forms the roof.

When the columns were completed by the general contractor, Thompson & Street, it was time for steel erectors and weldors to move in. Steel for the building was fabricated and erected by Southern Engineering Co. of Charlotte.

Shop fabrication was under the direction of T. H. Cato, plant manager, and J. W. Garrison was erection engineer on the job. These men played key roles in what is one of the nation's most unusual steel construction projects.

Tension Ring Fabrication

First steel members to arrive at the job site were 48 sections of the huge tension ring which runs around the tops of the columns. These segments, weighing 7½ tons each, were shop fabricated and welded into a solid steel ring as they were placed atop the columns.

The tension ring, which absorbs the tremendous outward thrust of the dome, is made of 32-in. by 2-in. steel plate, reinforced lengthwise by two parallel strips of 12-in. channel steel, a 6-in.-wide flange beam, and a 4-in. by 3½-in. angle bar.

There are 96 butt welds in the tension ring, a third of which were made in the field.

Once the tension ring was in place, it was necessary to build a temporary tower 12 ft square and 110 ft high in the center of the circle. On top of the tower was a platform 50 ft in diameter.

Purpose of the tower was to provide temporary support for the hub which forms the center of the spider-web-like frame of the dome. The platform served as an aerial base of operations for weldors who built a 40-ft compression ring around the hub.

Because of its weight and size, the compression ring had to be constructed in position. This ring absorbs inward thrust caused by the weight of the roof and the arched rib frame-

work of the dome.

With the compression ring in place, and the tension ring resting on the columns around the edge of the building, the next phase of construction was to connect these two rings with 160-ft ribs which fan out from the center to the outer edge.

Rib Connectors

These radial ribs were made of seven pieces of 18-in.-wide flange beam, each section 22½ ft long. Three of the butt welds joining these sections were made in the shop.

In order to complete rib fabrication, it was necessary to construct a steel jig 160 ft by 20 ft at the job site. This jig held sections in place while they were welded together on the ground.

Getting the ribs welded into proper position in the dome was one of the most difficult feats of the project. Extreme length and flexibility of the members added to the problem of hoisting them into place.

As each 160-ft span was put up, its position was checked by surveyors on the ground who communicated with erectors by field telephones.

Three of the main ribs were put in at each quarter-point of the dome. The remainder of the ribs were then installed and the whole tied in with secondary bracing.

When the framework was complete, the tower and platform were removed from under the center of the building, leaving the dome supported by perimeter columns and the balanced forces of its cantilever design.

CONNECTING rib sections are joined by weldors at coliseum job site. Large jig was built on location to hold parts at proper angle for fabrication.

The coliseum as it stands today is a remarkable tribute to welding. It required the work of 16 weldors qualified under standards set forth by the American Welding Society and the American Institute of Steel Construction to complete the job.

Welding Equipment

There were 12 stationary and 4 portable welding machines in almost constant use during erection. All of these were 300-amp machines, with the exception of two 200-amp welders used for tacking.

According to J. W. Garrison of Southern Engineering Co., the coliseum project was unusually difficult because approximately three-fourths of the welding had to be done in the field, and structural members had to be carefully fitted together, frequently at a height of 10 stories.

Careful allowance had to be made for shrinkage, ⅛-in. at each rib joint and 3/16-in. at each joint of the tension-ring plate. Mr. Garrison estimates that welding made possible a saving of about 25% in materials.

To have used any other means of joining would have necessitated use of heavier gusset plates and beam sections, he explained. Also, to have used any material other than steel would have created enormous problems.

Sleek design of this structure is a beautiful example of modern architecture and latest building methods. It is part of an auditorium-coliseum project which is costing the city of Charlotte $4,600,000.

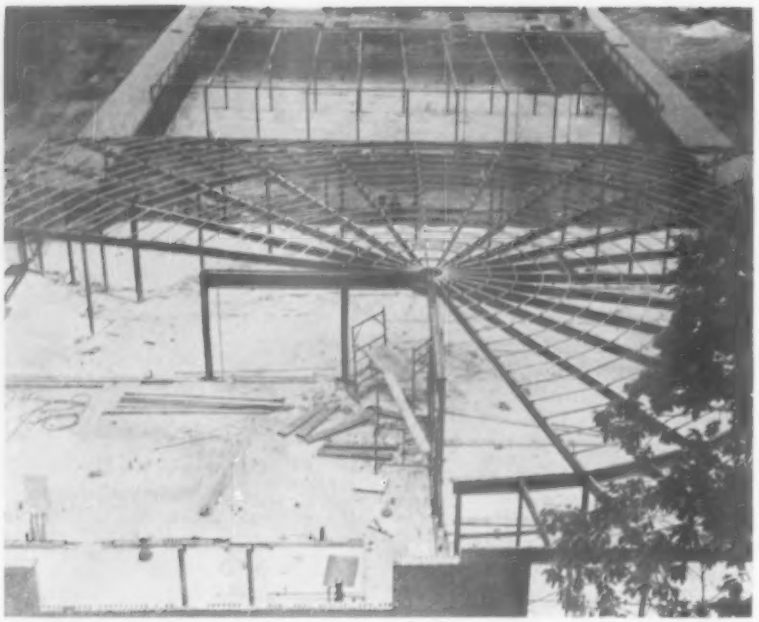
The auditorium, of conventional masonry and stone construction, and the all-welded coliseum, will comprise a vast entertainment center expected to attract visitors within a 100-mile radius of the city.

REARED against the sky are temporary tower and platform built in the center of the coliseum to support hub until compression ring and ribs could be welded in place. Seventeen of a total of 48 ribs are already in place.

In October . . .

. . . the captions for the line drawings on page 46 were transposed. The drawings, with captions in proper order, will be reproduced in the December issue when the second part of Joseph Holt's article on flame-straightening is published.

A school that's weld-built



BIRD'S-EYE view shows spider-web construction used on roof of combination cafeteria-assembly room at West Mecklenburg school. In the foreground is the cantilevered bearing "drum" supported by four vertical "H" beams and two horizontal "I" beams.

ALTHOUGH not as spectacular as Charlotte's coliseum, the new West Mecklenburg Junior High School, about four miles from Charlotte, N. C., incorporates several of the novel structural features used in the large entertainment center.

Like the coliseum, the school was designed by A. G. Odell, Jr., and Associates. It is of all-welded steel construction, and part of it has a circular spider-web design similar to the frame for which the coliseum is famous.

The structure of the entire building, with few exceptions, is made of 4-in.-square pipe columns and 12-in. by 3-in. box beams consisting of two lightweight stair string channels welded together. Pipe columns form the vertical supports, and the box beams are main horizontal members.

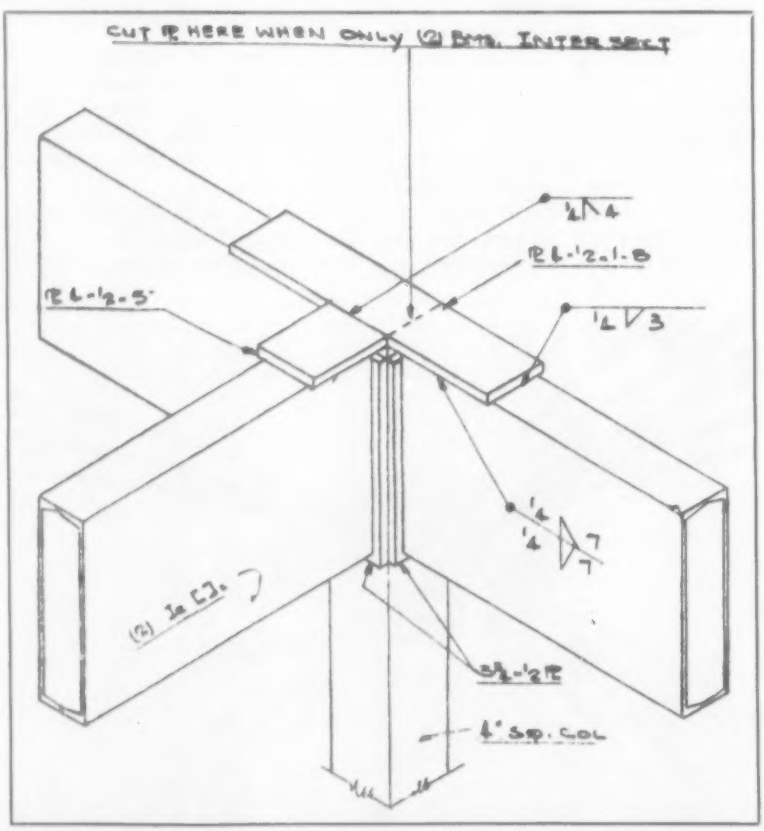
According to the architects, the new metal construction has a number of advantages applicable to general building.

Besides giving an attractive modern appearance, the design is surprisingly economical due to savings in labor and material. An estimated $100,000 was saved by the use of new design and construction methods.

Economy Features

The school building, for instance, has exterior walls made of steel and fiber glass panels only 1½ in. thick. Interior partitions are of plaster and are 2 in. thick.

These thin walls, according to the architect, increase usable space inside the building approximately 10 to 15%, resulting in a much lower cost per square foot of usable area. Other economies are achieved by a light steel frame and metal roof decking.



A NUMBER of typical welded connections in the framework of the West Mecklenburg school are shown in this blueprint. New design and welded construction saved an estimated $100,000.

L. J. POPE (left) and Troy Robinson, representing job contractors, inspect welds on box beams and bulb tees supporting roof of West Mecklenburg Junior High School.

L. J. Pope of Automatic Elevator Door Sill Co., sub-contractor in charge of erecting steel in the building, explains that welded construction makes it possible to use extremely light steel members for most of the frame.

Use of these light materials enabled erectors to put up steel about twice as fast as they could with heavier materials. All of the framework is welded, even down to the door jambs. The only bolts in the frame are in the expansion joints.

The unusual design also makes it possible to create large rooms with the floor free of supporting beams. A good example of this is the combination cafeteria and assembly room, a circular area 80 ft in diameter.

Radial Box Beams

Lack of columns from the floor adds appreciably to the usable space, and the round shape allows a larger number of people to be seated in the room in proportion to the amount of outside wall.

In order to achieve these features in the cafeteria-assembly room, the box beams radiate from a central cantilevered bearing "drum" to columns along the perimeter of the circular enclosed space. This bearing is held in place by two 18-in. "I" beams supported by four 10-in. "H" beams.

The "I" beams, which are horizontal members, form a right angle at the point where the bearing is joined. This is one of the few places in the building where fairly heavy beams are used.

Basic materials and some special steel sections were fabricated by Soule Steel and Iron Co. Most of the welding, however, was done in the field.

Roof Deck Support

In putting up some classroom areas, erectors made a temporary work table and welded together each bay section, which consists of a box beam and two 4-in.-square columns. After these were welded on the ground, the sections were pulled into vertical position with an "A" frame and winch mounted on a truck.

Once these sections were in place, they were tied together by 2½-in. bulb tees which run perpendicular to the box beams for the entire width of the building. The bulb tees, placed at intervals of 24 in. and 32 in., support the roof decking as shown in the photo above.

Instead of using inside halls, main areas of the school are connected by outside covered walkways. Walkway roofs are supported by 4-in.-square pipe columns, connected lengthwise at the top by 4-in. by 6-in. angle iron. This framework is covered with roof decking welded into place.

On this job, two gasoline-engine-driven welders, one 200-amp and one 300-amp, were used. In the process of erection a total of 1,470 lb of electrodes were consumed. These included E6012's, E6013's and E6020's.

Although the project involved a great deal of welding at the building site, the one-story design and lightness of members reduced problems to a minimum.

Commenting on the building, Mr. Pope said, "I've been erecting steel for 20 years, and this is one of the cleanest and finest jobs I've ever done. There were no particular problems involved. It was simply a matter of putting in the upright sections and then stringing the rest on top of them."

Electronic "private eye"

A group of employees at Ryan Aeronautical Co., San Diego, Calif., fire electrons from cathode "guns" to create magnetic fields and bathe metal in ultraviolet radiation. Something out of science fiction? Not in the least. They are production-line inspectors using advanced techniques to detect slight flaws in components for jet engines, afterburner rockets and ramjets.

TECHNICIAN positions 250,000-volt X-ray machine over large jet engine casing. Machine will penetrate 4½ in. of stainless steel

BY A. S. BILLINGS*

THE perfection of the microscope revealed the microcosmic world —a universe close at hand but too infinitesimal to see. With the microscope, "mountains" were discovered on the sharpened edges of razor blades and the fine points of needles were found to be truncated cones.

The microscope pioneered the science of metallurgy and established manufacturing on a precision basis.

But precision alone is not enough. Gleaming combustion chambers, seething afterburners and fiery rocket motors have to be as perfect internally as they are accurate dimensionally.

To insure this structural soundness, Ryan inspectors must look beyond the clean, hard geometry of the metal surfaces and peer deep into the heart of the alloys themselves. To do this, the newest "eyes" of science are harnessed—"eyes" that see far beyond the microscope.

X-Ray Inspection

Most striking tool of this type is the well-known X-ray machine. Ryan has stepped up its X-ray facilities and now has two complete installations capable of handling large volumes of work. X-rays are a form of radiant energy similar to light waves. They travel in straight lines, traverse empty space and affect photographic emulsions.

However, they differ from light waves in that they are much shorter. Visible light falls within a range where the waves are between 3,000 and 7,500 Angstrom units long. (One Angstrom unit is 1/250 millionths of an inch.) X-ray wavelengths run from 0.05 to 2 Angstrom units. Because of their short wavelength, X-rays can penetrate deep into solid matter.

Ryan X-ray technicians produce these penetrating waves with a Cooldige tube, which bombards a metal target plate with a fast-moving stream of electrons. As the swift electrons crash into the metal plate, their kinetic energy causes the metal to radiate streams of X-rays.

These are focused and directed through the metal part to be examined. After passing through the part, they impinge upon a photographic plate or film and effect its emulsion.

Some X-radiation is absorbed by the metal through which it passes and this absorption is proportional to the density. Consequently, all types of concealed discontinuties in the metal will show up as variations in the affects of the rays upon the photographic emulsion.

Defects Shown

Such welding defects as gas pockets, cavities, porosity, and shrinkage cracks will appear as darkened areas on the film because they permit greater amounts of radiation to pass. Inclusions such as slag, oxides and other foreign matter may show up either as darker or lighter areas, depending upon the density of surrounding metal.

By stepping up the power of the cathode "gun" that fires the electrons, it is possible to produce more powerful X-rays with greater penetrative properties. Ryan's largest machine employs a tube with a maximum output of 250,000 volts at 10 milliamperes. With this machine, it is possible to take radiographs through 4½ in. of solid steel.

Ryan inspectors subject all fusion welds on such vital components as Pratt and Whitney J-57 jet engines, Westinghouse J-46 afterburners and Boeing B-52 structural members to X-ray inspection.

*Quality control manager, Ryan Aeronautical Co.

Another non-destructive technique employed at Ryan to detect imperfections in metal parts is fluorescent-penetrant inspection. This is a sensitive method of surface inspection for finding minute cracks, pores and discontinuities in all types of metal.

Fluorescent Penetration

Defects concealed beneath a solid surface are, of course, not revealed. For the job that it does do, however, fluorescent penetration is even more effective than X-ray inspection, which will not disclose extremely small surface cracks.

Here is the procedure:

Parts to be examined are dipped into an oil-base, water-emulsifiable penetrant or are brushed or sprayed with the substance. The penetrant contains a mixture of fluorescent particles that will glow brilliantly under ultraviolet light. The coated parts are allowed to stand for about half an hour to permit the penetrant to seep into all fissures. They are then washed with a water spray to remove the penetrant from the surface.

While still wet, parts are sprayed with a developer compound consisting of a colloidal suspension of powdery materials. The developer is dried by placing the parts in an oven for five minutes.

As the developer dries, it draws the fluorescent penetrant from crevasses to the surface by capillary attraction. When the parts are viewed in a black-light booth, exuded particles glow with a fluorescent brilliance under ultraviolet radiation.

The exact pattern and location of each defect is vividly displayed by glowing particles. The depth of the defect may be estimated by the amount of penetrant emerging from the fissure.

Penetrants with exceptionally good properties of surface tension and viscosity can reveal surface cracks in non-porous materials only a few millionths of an inch in size. Because the method requires various types of equipment, fluorescent-penetrant inspection at Ryan is accomplished on a conveyor system, which carries parts through the application, washing, drying and viewing operations.

Fluorescent penetrants possess a particular advantage for parts that are to be reworked at a later time: fluorescent particles remain permanently in the metal cracks. Once treated, a part may be inspected many times by simply taking it into the black-light booth.

Dye Penetrants

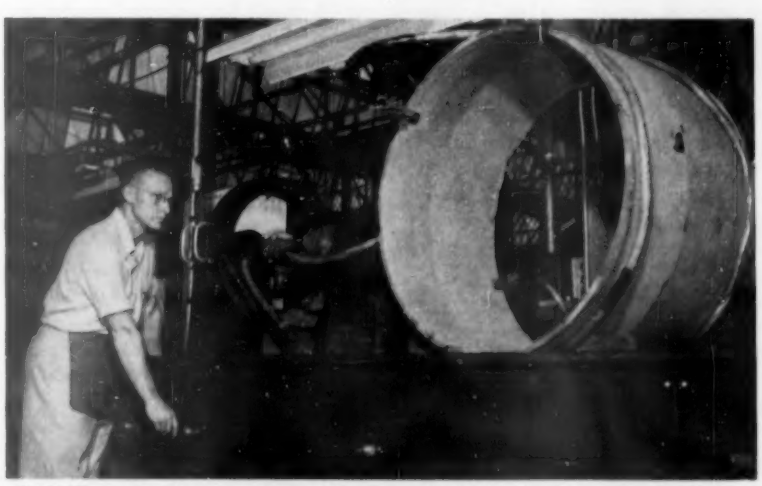
Dye-penetrant inspection is a simplified version of the fluorescent-penetrant method. It, too, is a mechanical method of detection for locating defects that extend to the surface. It requires an absolute minimum of equipment: three bottles and three brushes. Consequently, it is valuable for field inspection and as a means of checking large, immobile structures that cannot readily be inspected by other methods.

The three compounds needed are the dye penetrant, a solvent and a developer compound. Before examination, parts must be thoroughly cleaned of oil and grease. The penetrant, a low-viscosity, high-capillarity fluid containing a red dye, is applied to the surface by brushing, spraying or dipping.

Five to fifteen minutes permits the penetrant to soak into surface imperfections. The excess penetrant is then removed from the surface by washing parts with the solvent. When the parts have dried, a very thin coating of developer is brushed, sprayed or dipped on.

Capillary attraction exerted by the developer will draw quantities of red dye from any cracks or fissures existing in the metal. These will become readily apparent by contrast against the white background of the developer film. The location and extent of each defect is thus vividly indicated.

LABORATORY technician uses spectrograph to determine chemical formulae of metals received for production



LARGE jet engine component is magnetized by electric current flowing through it. Magnetized flux with iron oxide particles, spread on component, will respond to poles formed and show surface defects

Magnetic Particles

Unlike fluorescent penetrants, dye-penetrant indication is not permanant; the part will not show further indication of the defect without another treatment. Die penetrants are exceptionally convenient, however, for checking such parts as aircraft propeller hubs and landing gear without going to the trouble of disassembling them.

If parts are made from magnetic alloys, Ryan usually uses magnetic-particle inspection to find surface defects because it requires less time

SPECTROGRAM of metal sample is magnified in a densitometer and checked against standards by technician

than penetrant methods. This nondestructive technique is applicable to all sizes and shapes of parts.

Reduced Permeability

Parts are first dipped or sprayed with a thin oil containing iron oxide or other particles that will respond to a magnetic field. They are then magnetized, either by placing them within a solenoid or by passing a magnetizing current through them. Magnetization causes finely divided iron-oxide particles to adhere to any surface defect and thus show its pattern and location.

The principle behind this phenomenon may be summed up by the phrase "reduced magnetic permeability." Permeability is to magnetism what conductivity is to electricity. Cracks, breaks or spaces in the metal present a pathway of lesser magnetic permeability. As water flows around a stone in its path, so the magnetic field will "bow out" and pass around the discontinuity.

When the break extends to the surface, the magnetic lines of force leak out to form magnetic poles, which attract the iron-oxide particles. If the break lies just below the surface, enough magnetic flux may still be deflected to provide a visible surface indication of the defect.

Industrial Spectroscopy

If the discontinuity lies deep, however, the flux can probably find a pathway within the metal without leaking through the surface. Hence, no indication would occur.

Ryan uses another interesting inspection device that does not fall into either of these categories. This method is spectroscopy or spectrography.* Spectroscopic analysis is made to determine the chemical formulae of metals received for production. While this is not a nondestructive method, the few grains of metal consumed are negligible.

Metal samples from stocks of raw materials are sent by Ryan's receiving department to the engineering laboratory for spectrographic analysis. Similarly, all parts supplied by outside vendors are checked to determine whether or not their chemical analysis meets engineering specifications.

Vapor Analysis

A tiny sample of metal or a complete part may be analyzed with the spectrograph. This machine has two carbon electrodes, which vaporize a very small amount of the metal tested.

The light emitted by the metallic vapor is passed through a slit, to limit its height and width, and is then directed to a diffraction grating. The grating is a polished concave surface, upon which 48,000 parallel lines are ruled within a space of two inches. The grating breaks up the light into its component wavelengths (as a glass prism does) and reflects it to a strip of film.

The developed film reveals a series of light and dark bands, position of which depends upon the wavelengths present. This photographic negative, called a spectrogram, is taken to another instrument known as a "densitometer," which throws an image in magnified proportions on a ground glass screen. Here the pattern is checked against a standard.

By comparisons with master spectra, it is possible to tell exactly which elements are present in the original metal sample and their relative amounts. Traces as small as 1/1,000-th of one per cent are often detected.

X-Ray Metallography

By comparing intensities of the spectrum bands with known standards, it is possible to guess well the amounts of each element present. If exact amounts are required, an exact quantitative analysis of the sample is made through wet chemical methods.

Although X-rays were discovered in 1895, their true nature was not known for many years. As they have become better understood, they have opened new vistas for metallurgists.

Previously, the principal tools for metallurgy were the microscope and spectrograph. Both depend upon the optical properties of visible light and both have a resolving power limited by the wavelength of light.

X-rays have much shorter wavelengths. They offered a new potential but could not immediately be harnessed for probing matter because of the lack of a suitable diffractive mechanism.

The spaces of optical diffraction gratings were much too wide, even when they were as fine as human hands could possibly make them. A brilliant genius then conceived the idea of using the actual spaces betwen the atoms of a solid body to serve as a diffraction grating.

The atoms of some solid bodies are arranged in neat crystalline patterns, spacings of which are close to the wavelengths of X-rays. Experiments were conducted in which X-rays were projected through crystals and directed to photographic plates.

Experimental Results

These experiments proved conclusively that: *(1)* X-rays can be diffracted by this means, and *(2)* that the atoms of crystals are arrayed in precise space lattices as theoretically conjectured. Diffracted X-rays bounced off the crystals with definite direction and intensity, both of which could be measured by proper instruments.

From these early investigations, X-ray metallography was born. Metallurgists now can examine crystalline bodies with diffracted X-rays and tell a great deal about their physical structure and molecular architecture.

For instance, it is possible to determine whether cystals are cubic, haxagonal or tetrahexagonal; whether or not heat treatment has caused structural changes; or whether more than one "phase" of the metal is present.

With a resolving power several hundred times that of light waves, X-rays are giving the metallurgist a new fundamental knowledge of matter. His eyes are no longer limited by the vision of the microscope.

*When photography is used with a spectroscope, the instrument is known technically as a spectrograph.

Automatic submerged-arc welding needs:

Improvements in design performance

BY A. J. ROSENBERG and B. TOWNSHEND*

THE IMPORTANCE of automatic arc-welding methods has increased significantly in recent years. Reliable equipment has become available which will permit rapid and repetitive welding with consistent and dependable quality.

Yet, one major advantage of automatic techniques — improvement in design performance—has generally been overlooked. This is particularly true of fillet welds where current design practice is based entirely upon data obtained for manual metal-arc welding.

In manual fillet welding, it is assumed that weld fusion extends only to the intersection of members forming the joint (see Fig. 1A), and strength is therefore based on a throat dimension equal to "t" in the figure.

As strength requirements are increased, current design practice requires increased fillet sizes or the addition of gussets, reinforcements or specially prepared beveled edges.

Actually, however, weld fusion does not stop at the joint intersection, but extends into the base plates a definite amount, depicted in Fig. 1B as "p". This root penetration can provide a considerable safety factor in manual designs, and significant strength advantages in automatic methods where penetration can be predetermined and consistently repeated.

Seeking Design Standards

It was the purpose of this investigation to evolve mechanical design standards for automatic submerged-arc welding which take into account the beneficial effects of penetration.

At the same time, the influence of welding variables was studied so that optimum welding conditions could be suggested. Experimental data was determined for automatic submerged-arc welding of low carbon steel. The design information can be applied equally to other materials and other automatic processes.

*Both authors are in the Welding Engineering Unit of the Thomson Laboratory at General Electric Co.'s River Works in Lynn, Mass.

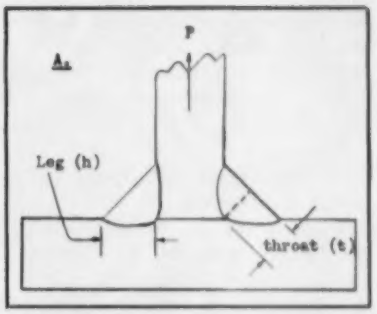


FIG 1A—Drawing indicates generally assumed depth of weld fusion in manually welded fillet. Strength rating is usually based on a throat dimension equal to "t".

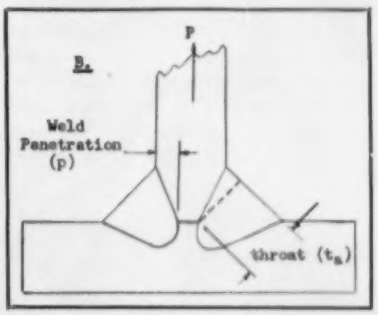


FIG. 1B—Weld fusion actually extends well into base plates, as shown in this fillet welded by automatic submerged-arc process. Appreciation of full root penetration can improve design standards.

Transverse shear test specimens of the type shown in Fig. 2 were welded under a variety of welding conditions. Fillet sizes ranged in 1/16-in. increments from 3/16-in. to ½ in. Root penetration ranged from less than 10% of weld size to more than 50%.

Fig. 3 summarizes test results in terms of measured penetration and transverse shear strength per linear inch of weld for each weld size studied. Also included for comparison are three calculated shear strength curves.

Reference curves (a) and (b) naturally show a straight-line increase in strength with penetration, while curve (c) drops off with increasing penetration because of dilution with lower-strength base metal.

Test Interpretations

In general, test points fell above curve (c), although scatter was wide. Statistical study and comparison between test values and those calculated for the diluted weld area indicated that slopes of the two curves were comparable. It is reasonable, therefore, to conclude that penetration and

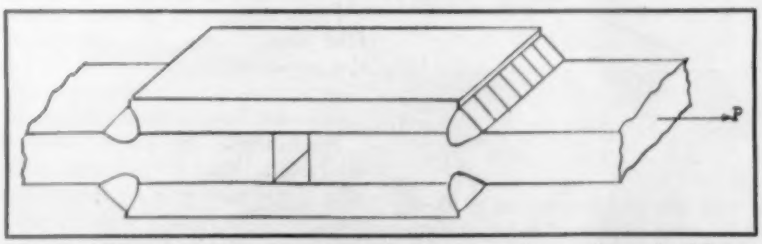


FIG. 2—Effects of weld penetration upon joint strength were determined from fillet welds like this. "P" marks depth of root penetration.

dilution are both important factors which should be taken into consideration in design calculations.

When weld metal strengths are equal to or only slightly higher than base metal being welded, it is convenient to use the straight-line curve (b) in calculations.

When a higher strength welding material is employed, however, advantage should be taken of increase in strength thus made possible. In either case, penetration should be a factor in design calculations.

Industry design data for fillet welds usually does not distinguish between longitudinal and transverse loading, nor does it take penetration into account. Further, since values listed were based on test data for manual metal-arc welding where percent of penetration decreases with fillet size, values fall below a "zero penetration" curve based on 60,000 psi tensile strength.

Fig. 4 includes this data and a third curve showing transverse shear strength for fillet welds possessing 25% penetration. It is recommended that this amount of penetration be established as a minimum process requirement for automatic submerged-arc welding of fillets. The strength values in Fig. 4 should be used in design for this condition.

Decreasing Weld Sizes

Use of smaller weld sizes made possible by higher design values has several apparent advantages: decreased distortion due to weld contraction, and significant electrode savings.

For example, from Fig. 4 it is apparent that a ¼-in. fillet weld could be used to develop strengths now gained from a 5/16-in. weld. A ⅜-in. weld would come close to replacing the 9/16-in. size.

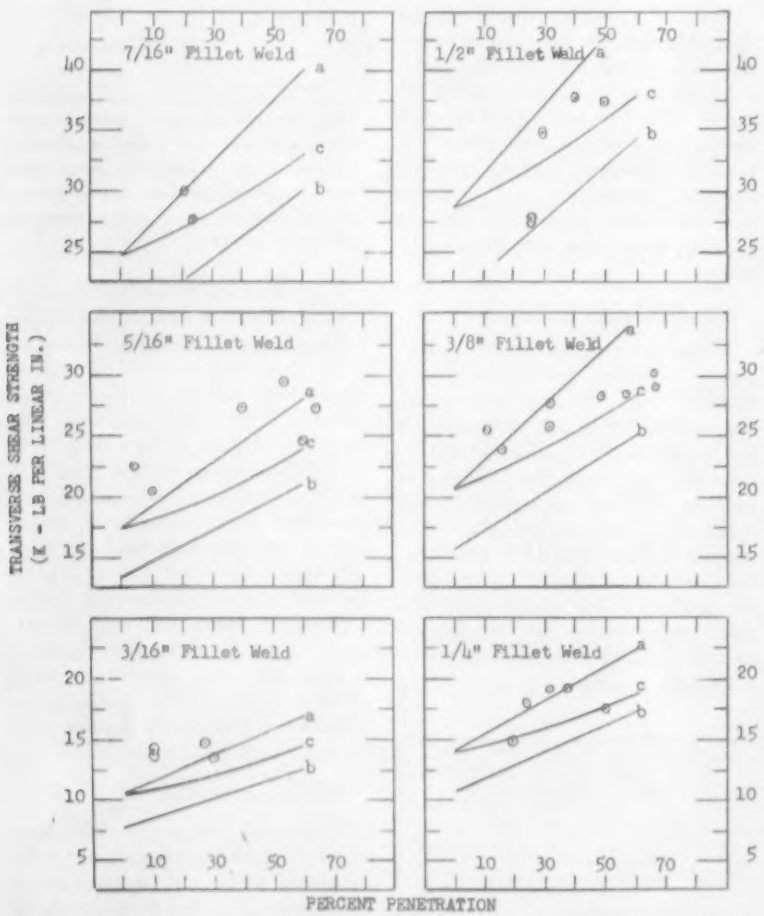


FIG. 3—Graphs of test results relating weld size and penetration to shear strength. Solid lines are calculated values based on: (a) weld metal strength of 80,000 psi; (b) base metal strength of 60,000 psi, and (c) combined weld-base metal strengths varying with amounts of dilution.

The case for copper

In its September, 1955, issue, WELDING ENGINEER presented the article, "Aluminum vs. copper cable." A representative of aluminum cable manufacturers stated the reasons which, from his point of view, made aluminum welding cable a superior product.

The editors pointed out that they were not taking sides in the question, and invited a manufacturer or user of copper cable to submit his views. This offer has been accepted.

Don't miss this interesting response in the December issue of WELDING ENGINEER.

In the first case, a saving of 37% in filler material could be realized, while in the second, as much as 55% would be saved!

Further, the ⅜-in. weld size is normally considered the maximum size obtainable in a single pass in the horizontal position. Use of increased design values broadens tremendously the application of single-pass horizontal welding of fillets.

Once fillet weld size has been determined from design requirements, it becomes necessary to develop welding procedures to meet these requirements. While this is most often accomplished through trial and error work on simulated samples or actual production parts, data obtained during the course of this investigation should prove extremely useful in predicting optimum welding conditions.

Preferred Factors

From an economic point of view alone, "optimum" may be synonymous with maximum weld deposition rate. However, definite preferred ranges of current, travel speed and wire diameter do exist and should be taken into account in establishing weld settings.

From attempts to produce certain fillet sizes, it was soon recognized that upper limits of travel speed existed beyond which weld quality and appearance became unacceptable.

For example, deposition rate necessary to produce a ½-in. fillet weld in a single pass at a 30 ipm travel speed is well beyond that possible with conventional equipment. On the other hand, ¼-in. fillet welds can

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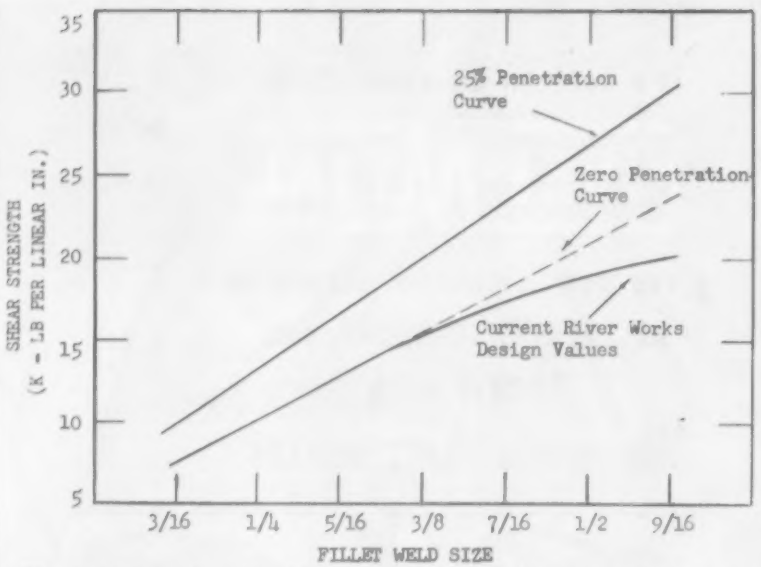

FIG. 4—Design values of welds having 25% penetration compared to current Lynn (Mass.) River Works standards.

readily be achieved at travel speeds as high as 40 ipm.

The relationship between deposition rate and a-c welding current was established for several wire sizes by depositing bead-on-plate welds employing currents ranging from 250 to 1,000 amp. Samples were weighed before and after measured time intervals of welding and deposition rates were determined from these test results.

Such secondary variables as flux type and electrode extension from the contact jaws were maintained essentially constant. As with travel speeds, definite preferred ranges of current could be established for fillet welds beyond which weld quality was unacceptable.

The fact that 3/16-in. wire provided greater deposition rates at any given value of current than 5/32-in. material cannot be fully explained, although the means for adjusting wire feeds with the laboatory equipment employed may have accounted for the discrepancy.

Higher Travel Speeds

Newer submerged-arc welding equipment possesses automatic adjustments which should avoid similar inconsistencies. While arc voltage has some effects on weld quality, it was not evaluated in this study.

In utilizing this information to establish welding conditions, one additional factor must be considered: the effect of welding variables on weld penetration. Earlier work in G.E.'s Schenectady Works laboratory established that both deposition rate and depth of penetration increased directly with increasing currents. Thus, high travel speed is desirable from a performance point of view as well as an economic one.

If design requirements dictate a ⅜-in. fillet weld, a maximum travel speed of 25 ipm is recommended, requiring a deposition rate of almost 30 lb per hour. This deposition rate can readily be obtained with 3/16-in. filler wire, but requires a power source capable of delivering over 800 amp.

On the other hand, if a 500-amp transformer were available for this work, it would be capable of depositing 5/32-in. filler wire at a rate of 15 lb per hour, sufficient to produce a ⅜-in. fillet at almost 15 ipm.

Advantages of increased travel speeds must then be weighed against the cost of additional equipment. While penetration at the lower current will be less than at 800 amp, the value will still exceed the proposed 25% minimum.

In choosing between overlapping wire sizes, cost dictates selection of the largest useful diameter. However, smaller wire sizes are more readily handled in setting up equipment and welds made at high current densities usually have a better appearance than those made using lower values.

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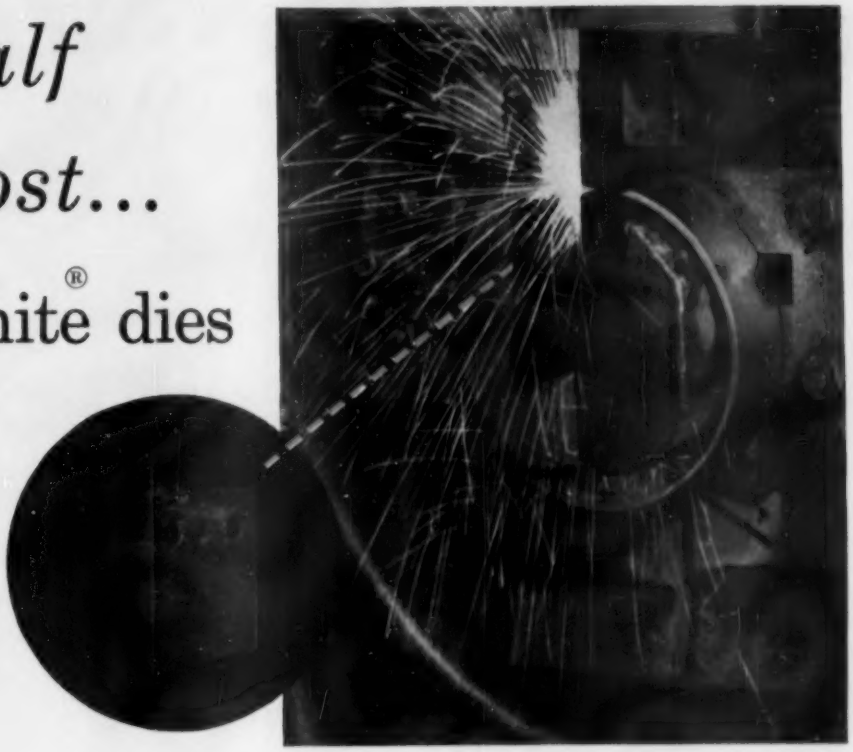

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EXPERIMENTAL house, of welded lightweight steel, may set the pattern for future home-building.

Lightweight steel + welding = low cost home

The novelty of welded steel frame homes is slowly wearing off, and many architectural experts agree that within 10 years almost all homes will be constructed with metal framework.

WELDED houses continue to make news!

In recent weeks, several new types of steel homes have received much attention from the daily press. Foremost among these is a welded lightweight steel home built in Barrington, Ill., a suburb northwest of Chicago.

The modern and attractive experimental house might well become the answer to the nation's quest for quality housing at low cost, for its architects believe that it would be possible in mass construction to erect the basic structure (of rigid bents), including floors and decking, in *one* working day.

This would be possible by shop-welding the entire frame, which consists of 12-in. lightweight junior beams as floor joists, 4-in. by 4-in. columns and 10-in. beams as roof rafters.

In the experimental house, these rigid frames are spaced on 5-ft. modules and are supported by masonry-bearing walls. Total weight of all beams used in the house pictured above is 5,831 lb. The low figure is possible because the 12-in. beams weigh only 11.8 lb per lineal ft. Workmen were able to handle the beams without a crane.

Research Village

Located in the United States Gypsum Co.'s Research Village at Barrington, the house's basic structure is fabricated from corrosion-resistant, copper-bearing steel beams made by Jones & Laughlin Steel Corp., Pittsburgh.

The roof has a total design load of 44 lb per square foot, the floor 64 lb per square foot.

Planking is the metal-edge type made by U.S. Gypsum. This edging is 21-gage galvanized steel formed into tongues and grooves. The planks have additional integral reinforcement in 16-gage galvanized, electrically welded steel mat.

According to U.S. Gypsum, this was the first time its metal-edge plank was joined to steel beams by welding. It ordinarily is attached to supporting purlins by clips.

Beams and columns were fabricated in the shop, and connections were temporarily made with bolts. In the field, the bents were welded onto the floor joist beam to make a rigid frame. This experience convinced the general contractor that a better job and a handsome saving could be effected by welding the complete rigid frame in the shop.

All welds joining the metal-edge gypsum planks to the top flanges of

PLANK type used on roof is used also for floors. Here one is being welded to floor joist, which together with columns and rafters forms basic structure of house.

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By depositing smooth-flowing and low-fuming weld metal, these rods promote faster, more uniform work and thereby reduce production costs. The 18 braze welds pictured are made in 8 minutes—an average of about ½ minute per joint.

Anaconda-997 Low-Fuming Bronze is a superior welding rod used to join gray and malleable cast iron, steel and copper alloys by the oxyacetylene process. It is also used for repair welding, and to deposit bearing surfaces on steel and iron. You can get other Anaconda Copper Alloy Welding Rods for many different production and repair purposes. They are sold by distributors of welding equipment everywhere.

Anaconda distributors are also a good source of practical advice on welding problems. Purity Cylinder Gases, Grand Rapids, Mich., and Warsaw, Ind., furnish Peabody with Anaconda-997 Rods. For additional information write for Publication B-13. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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RIGID framework, if shop welded, could be erected in one day, according to architects.

beams are concealed in final construction. Together with the welded frames, this connection between plank and beams or joists forms a completely rigid structure.

Dimensions of the lightweight beam comply with minimum thickness specifications of the American Institute of Steel Construction for Design, Fabrication and Erection of Structural Steel Building (Section 18).

Here are some of the reasons the architects chose welded steel for the experimental house:

Steel provided long spans required in floor construction without excessive weight and apparent mass of other materials, such as wood or precast concrete.

The lightweight sections were more efficient and economical for design requirements than heavy steel.

Space Saving

They saved space in both wall and ceiling construction. There are no furred ceilings; consequently, the building height may be reduced without psychological loss of space or headroom.

Structural steel reduces maintenance inside and out and offers fire resistance.

Rough carpentry was eliminated. Finished carpentry was confined to installation of shop-built units.

Architects were Brooks & Coddington, Columbus, Ohio; Maxon Construction Co., Barrington, was the builder and W. Alex Simms, Dayton, Ohio, the consulting builder. Welding sub-contractor was Waukegan Steel Sales, Inc., Waukegan, Ill.

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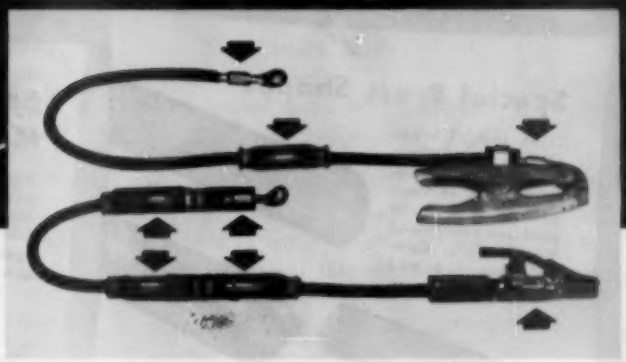

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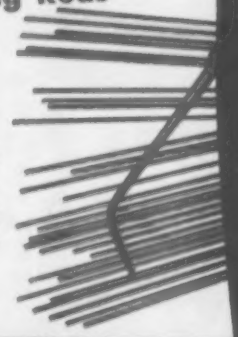

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COPPER: The element copper commercially pure or alloyed with not more than 1% of other elements. The term "copper" is generally modified to indicate either its method of production or the alloying material that is present. Typical examples are:

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Oxygen-free copper
Fire-refined copper
Silver-bearing copper
Phosphorized copper
Tellurium copper
Selenium copper
Leaded copper

BRASS: An alloy of copper with zinc as the principal alloying element, with or without small quantities of some other elements.

Gilding, 95%
Red brass, 85%
Low brass, 80%
Cartridge brass, 70%
Yellow brass
Muntz metal
Forging brass
Naval brass
Aluminum brass

Some brasses, because of their appearance or because of some particular property, are commercially called bronzes. For example:

Commercial bronze, 90%
Leaded commercial bronze
Architectural bronze
Manganese bronze

Brasses to which lead has been added to improve machinability are known as "leaded brasses" and include the following:

Low-leaded brass
Medium-leaded brass
High-leaded brass
Extra-high-leaded brass
Free-cutting brass
Leaded Muntz metal
Free-cutting Muntz metal

The alloy commercially known as "nickel silver" is a brass in which the element nickel has been substituted for part of the zinc. Where two numerals appear after the name, they indicate the percentage of copper and nickel, respectively. For example:

Nickel silver, 55-18
Nickel silver, 65-15
Leaded nickel silver, 61.5-12
Extruded leaded nickel silver

BRONZE: Originally the term for copper alloys having tin as the only or principal alloying element. In modern usage, the term "bronze" is seldom used alone, and the terms "phosphor bronze" or "tin bronze" are considered preferable for indicating the copper-tin alloys. Thus:

Phosphor bronze, 5%
Phosphor bronze, 8%
Free-cutting phosphor bronze

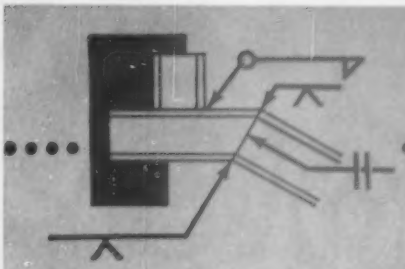
The term "bronze" suitably modified has been extended to apply to any of a variety of copper-based alloy systems, particularly where the element alloyed with the copper is present in not much more than 10%. For example:

Aluminum bronze (copper with aluminum as the principal alloying element)
High silicon bronze (copper with silicon as the principal alloying element, with or without small percentages of other elements)
Low silicon bronze (similar to high silicon bronze with less silicon)

These usages for the term "bronze" have gained widespread acceptance. This, of course, excludes the brasses which include the word "bronze" in the title but which, by definition, are actually brass. (See brass).

CUPRO NICKEL: Cupro nickel, an alloy of copper and nickel with the nickel content usually being 10, 20 or 30 per cent, does not fall readily into any of the foregoing definitions.

Courtesy Copper & Brass Research Association



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Induction heating and brazing

Question:

What is induction brazing, and how does it differ from resistance brazing?

Answer:

To fully understand induction brazing, you must first be acquainted with induction heating.

Induction heating is a method of raising the temperature of a material by means of electrical generation of heat within that material, and not by any other method such as convection, conduction or radiation.

It is essential that the material shall not be part of a closed electrical circuit supplied from a source of electrical energy as is the case with resistance heating.

Induction will produce a fast localized heat capable of being controled within close limits to any predetermined temperature. Also, the method is readily adaptable to mass production.

Induction heating is a phenomenon caused by an alternating magnetic field. Such a field occurs in the area surrounding a conductor carrying an alternating current, and the reversals of the magnetic field follow the reversals of current in the conductor.

Magnetic material, if placed within this type of field, is heated by both hysteresis (the tendency of magnetism to lag behind the current producing it), and eddy current losses (wasted energy creating heat).

Hysteretic loss is caused by molecular friction within the material, and the magnitude of this loss is directly proportional to the frequency of the magnetic field.

Eddy current losses are resistance losses resulting from small circulating currents within the material. This loss is proportional to the square of the frequency and the square of the current in the field-producing conductor.

Brazing by induction heating, then, is accomplished by placing the joint to be brazed in an alternating magnetic field. This type of heating is applicable to either magnetic or nonmagnetic materials.

Heating of the latter depends solely upon eddy current losses. Since the resistance of non-ferrous (nonmagnetic) metals is usually less than that of ferrous materials, this loss is comparatively small. Hence, a stronger magnetic field must be used to obtain comparable heating results.

Eddy current losses are a function of the frequency reversal of the magnetic field, and the frequency of the field is determined by the frequency of the current flowing conductor.

Therefore, it is necessary to go to high frequencies in order to secure an appreciable heating effect.

There are three available sources of electrical energy at frequencies, and with capacities, suitable for commercial induction heating. These are the rotating electrical generator, the resonant spark-gap circuit, and the vacuum tube oscillator. These sources cover a frequency range from 1,000 cycles to 5 megacycles.

Each method has its inherent advantages and disadvantages.

Resistance brazing differs from induction brazing in that in the former process coalescense is produced by the heat obtained from resistance to the flow of electric current of which the *workpiece is a part.*

In *induction* brazing, coalescense is achieved by the heat obtained from resistance of the work to the flow of induced electric current.

In both methods a non-ferrous filler metal is used—one having a melting point above 800 F, but below that of the base metals. The filler metal is distributed in the joint by capillary attraction.

—From *The Welding Encyclopedia*

* * *

Question:

What is salt bath brazing?

Answer:

Salt bath brazing is a process wherein the parts to be joined are dipped into a bath containing a salt of definite brazing temperature (higher than 1,000 F, but lower than the melting point of the base metals).

Because the salt has a definite known melting point, the temperature of the bath is known; by dipping the parts to be brazed with a brazing alloy ring into the bath for a predetermined length of time, coalescense is achieved.

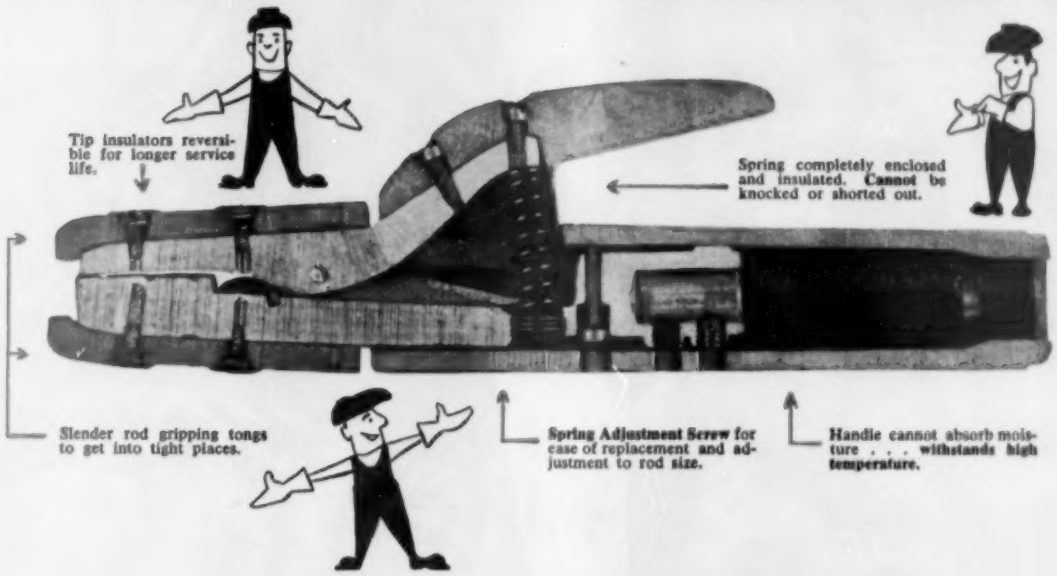
High-temperature neutral baths, used primarily in heat treatment of high-speed steels, may also be used for copper brazing. Avoiding contamination of neutral-type baths with cyanide salts is one of the precautions which must be taken in using various types of salt baths. Overheating should also be avoided.

40th Anniversary Issue

WELDING ENGINEER will mark its 40th year of service to the welding industry with its January, 1956, issue.

Watch for this special anniversary issue.

NOW YOU CAN SEE THE DIFFERENCE


Tip insulators reversible for longer service life.
Spring completely enclosed and insulated. Cannot be knocked or shorted out.
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Our F-2 HI-AMP Holder for 1/8" rod or smaller, carries a full 200 Amp. load without generating excessive heat, and it only weighs 12 ozs. Be sure to see this model too!

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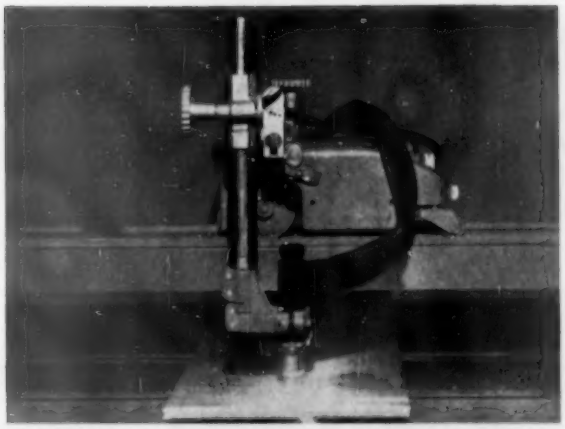
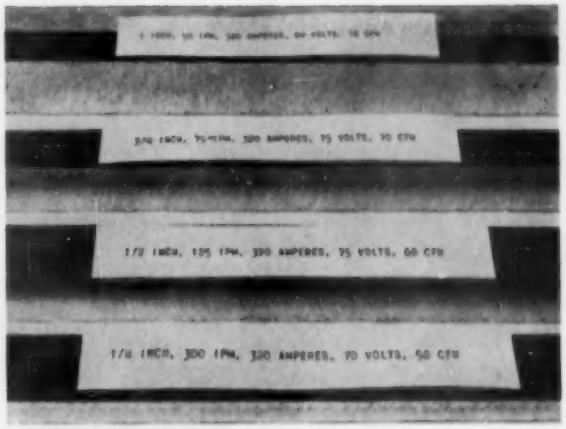


MACHINE application shows efficiency — but not high speed — with which new Tig cutter slices aluminum plate. Future use on all non-ferrous metals is research goal.



SAMPLES of four thicknesses of aluminum cut with Tig torch. Cut is clean, requires no edge preparation, and shielding gas prevents oxidation of cut face.

WELDER CONVERSION:

Big switch makes Tig torch a cutter

A VARIATION on a well-known welding process has given the industry an entirely new process for cutting and shaping non-ferrous metals. The Tig (tungsten inert-gas) welding torch, with some alterations, will now quickly and easily cut these relatively soft metals that could never before be cut at high production speeds.

Displayed for the first time at the National Metals Show in Philadelphia, October 17 to 21, the new cutter was developed by Linde Air Products Co., a division of Union Carbide and Carbon Corp.

Tig cutters have performed with saw-like quality on aluminum plate, the only non-ferrous metal on which it has been tested so far. Linde, however, has expressed confidence that the process can be used successfully in cutting and fabricating all non-ferrous metals.

In Tig cutting, a very high-temperature, high-velocity, constricted arc is maintained between a tungsten electrode and workpiece. Jet-like action of the concentrated arc energy ejects a thin section of the molten metal to form a kerf. The gas atmosphere prevents oxidation of the cut face.

Although the process may be used in both manual and automatic applications, the cutter's high speeds lend themselves more readily to an automatic operation.

Cutting Speeds

Normal mechanized cutting speeds reportedly are 300 ipm in ¼-in. material, 125 ipm in ½-in. metal, 75 ipm in ¾-in. plate and 50 ipm in 1-in. material. Since the cutter performs best at high speeds, continual loss of the arc may result if it is used by an operator who is unable to maintain a higher than average rate of travel.

Tig cutting provides an added advantage over the use of saws and planers in that it will cut straight lines, bevels, circles and shapes.

Both manual and automatic Tig torches must be fitted with a new collet and collet body for the cutting operation. This compact unit contains water-cooling tubes inside the torch body.

A new and different nozzle type has been fabricated for the cutting conversion. It holds a replaceable, hard-drawn copper insert.

Inclusion of an additional electric circuit called the "pilot-arc" circuit is still another change in design of the basic Tig torch. This circuit, which has a resistor to limit current from the power supply to the nozzle, initiates the cutting arc.

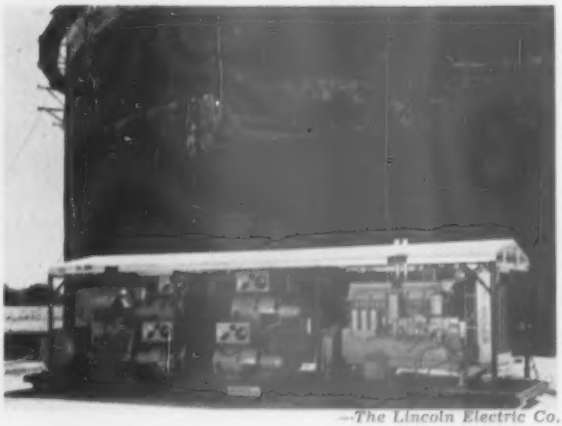
Shielding and Cutting Gas

A mixture of argon and hydrogen gave best Tig cutting results during extensive testing procedures. In an automatic application, the optimum mixture was 65% argon, 35%hydrogen, which developed a high arc voltage. The same arc voltage, however, could also be obtained with a power supply having an open-circuit voltage of 100 volts.

Optimum mixture for a manual Tig cutting application is approximately 80% argon, 20% hydrogen. Less hydrogen is used here to allow greater variations in arc length.

Maximum cutting speeds, even with the lower voltage at the 80-20 mixture, reportedly can be obtained without sacrificing quality of cut. Normal cutting speed in a manual application, as stated by the manufacturer, should be 60 ipm on ½-in. aluminum plate.

Pure argon is used to start and maintain the pilot-arc in manual cutting. Once the cutting arc has been struck, required mixture is obtained by addition of hydrogen to the flowing argon.



—*The Lincoln Electric Co.*

LEFT: Replacing individual gasoline engine-driven welders, this unit powers eight 400-amp welders. It consists of a Caterpillar Diesel engine (developing 191 hp at 1,200 rpm) connected to a jack shaft which drives the welders with V-belts. A 182-cfm air compressor is attached to the end of the jack shaft with a clutch. Power is said to be steady, and fuel savings of about $45 per day are reported.

on the job . . .

—*Linde Air Products Co.*

ABOVE: Weldor fuses one side of paper-thin, stainless combustion chamber for midget jet engine. Formed in halves, chamber is fitted over mandrel and held in a steel fixture. Tig torch completes 21½-in. weld in three minutes.

RIGHT: Note weld on completed midget jet, which is similar to one which powered a miniature plane to a world speed record of 179 mph.

—*Ingalls Shipbuilding Co.*

ABOVE: Bare skeleton of future 50-ton crane dwarfs weldors and chipper. Scheduled to be placed aboard Navy LSD's, 16 cranes of this type presently are being fabricated.

LEFT: Automatic open and submerged arc processes were used in the fabrication of this special track-type tractor. Admiral Richard E. Byrd will take 21 such tractors with him in November when "Expedition Deep-freeze" is launched to establish three Antarctic observation sites. This modification of a standard model has special nine-roller track frames, 54-in. shoes and a 106-in. gage. All tractors will be equipped with a hydraulic dozer and a towing winch.

(Photo courtesy Caterpillar Tractor Co.)

Feeding-tubes for hungry engines do a vital job . . .

Radiography proves each joint qualifies

GETTING the food and drink to the several thousand "metal horses" in a modern aircraft engine is no job to be taken lightly. Dependability is paramount. Safety a must. And lightness a prerequisite.

Joining these vital feed lines is a job for welding and brazing. And with radiography to prove each joint sound, there can be no dispute as to the acceptability of the work.

Here again, radiography has greatly extended the fields where welding can be used. It can bring you new business, too. To explore what radiography can do for you, get in touch with your x-ray dealer and talk it over.

EASTMAN KODAK COMPANY
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Radiography

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Grinding wheels are safe . . . use but don't abuse

DON'T

1. **Don't** use a wheel that has been *dropped.*
2. **Don't** *force* a wheel onto the machine or alter the size of the mounting hole—if wheel won't fit the machine, get one that will.
3. **Don't** ever *exceed* maximum operating speed established for the wheel.
4. **Don't** use mounting flanges on which the bearing surfaces *are not clean and flat.*
5. **Don't** *tighten* the mounting nut excessively.
6. **Don't** *grind* on the *side of the wheel* unless wheel is specifically designed for that purpose.
7. **Don't** start the machine until the *wheel guard is in place.*
8. **Don't** *jam* work into the wheel.
9. **Don't** *stand directly in front* of a grinding wheel whenever a grinder is started.
10. **Don't** grind material for which the wheel is *not designed.*

DO

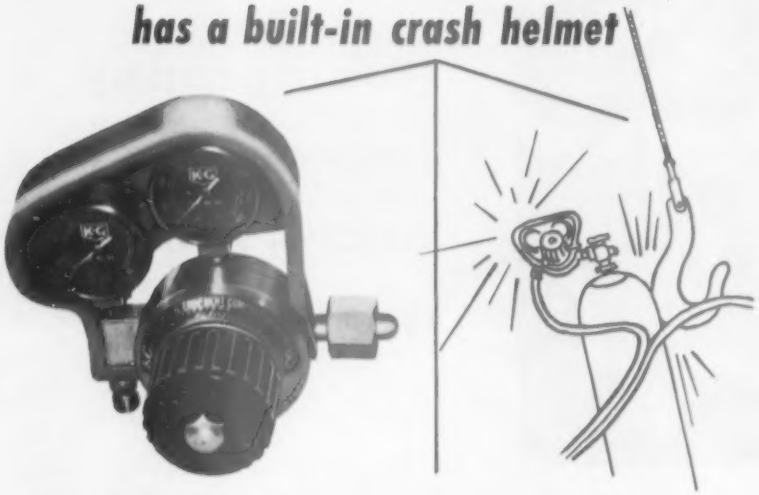
1. **Do** always handle and store wheels in a *careful* manner.
2. **Do** visually *inspect* all wheels before mounting for possible damage in transit.
3. **Do** *check maximum operating speed* established for wheel against machine speed.
4. **Do** *check mounting flanges* for equal and correct diameter. (Should be at least ⅓ of diameter of the wheel and relieved around hole.)
5. **Do** use *mounting blotters* supplied with wheels.
6. **Do** be sure *work rest* is properly adjusted. (Center of wheel or above; no more than ⅛ in. away from wheel.)
7. **Do** always *use a guard* covering at least one-half of the grinding wheel.
8. **Do** allow *newly mounted wheels to run* at operating speed, with guard in place, for at least *one minute before grinding.*
9. **Do** always *wear safety glasses* or some type of eye protection when grinding.
10. **Do** *turn off coolant* before stopping wheel to avoid creating an out-of-balance condition.

Tack this up near your grinding machine.

—Courtesy Grinding Wheel Institute

The NEW K-G "On Guard" REGULATOR

has a built-in crash helmet



The unique steel gauge guard on the new K-G "On Guard" Regulator fills a long-felt need. Like a built-in crash helmet, it protects the gauges against the hard knocks that are all in the day's work.

But this is only one of several valuable features, exclusive with K-G, that make the new regulator superior to others in economy, safety and performance. Strong, long-lasting stainless steel is used generously at all critical points such as the reinforced inlet nipple, the internal adjusting screw, valve stem and other internal parts.

A fully enclosed thrust-bearing, integral with the adjusting mechanism, provides smooth, easy pressure adjustment. Body and bonnet forgings, of a new aluminum alloy, have exceptional strength and corrosion resistance. Precision internal parts are protected by a sintered stainless steel Pressure Check Filtering Unit, eliminating the basic causes of regulator failure.

Available in both single and two-stage models for most gases. Send for new bulletin.

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With an OXWELD Automatic Tracer

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No need to allow for kerf in the size of templets—you merely set a dial to compensate for the kerf width of the nozzle in use. Parts are reproduced to tolerances ranging from plus or minus 7/32-in. to 1/16-in.—clean and smooth, and at high speeds.

Simple to set up—no special tools are required for making templets, they can be cut from VINYLITE plastic sheets with a knife or shears . . . The templet is simply mounted on the tracing table with masking tape. Your LINDE representative will be glad to discuss your needs, and help you determine the best setups for your oxygen-cutting operations. Start saving now—call him today for more information.

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CENTRAL Zone Vice-President R. P. Tarbell presided at meeting. Right is Bob Fernley, secretary-treasurer.

PORTION of shirtsleeve crowd at Grand Rapids. Warm weather failed to keep delegates from sessions.

Theme of NWSA zone meetings:

"Looking ahead"

By a Staff Member

TWO ZONE meetings of the National Welding Supply Association held in recent weeks indicate that this year's theme—"Looking ahead in the welding industry"—is attracting a great deal of attention.

The Central Zone gathering in Grand Rapids, Mich., was attended by 126 delegates, befitting that group's first-place standing in membership among NWSA zones. The earlier Eastern Zone session in Montreal reported a registration of 120 persons. (The West Central group met Oct. 31 and Nov. 1 in Kansas City, Mo.; the Western Zone is meeting Nov. 3-4 in Los Angeles.)

The New Line

At Grand Rapids, delegates heard Harry M. Johnson, Wayne Welding Supply Co., Inc., Fort Wayne, Ind., describe his firm's methods of promoting a new line.

C. I. MacGuffie, Welding Dept., General Electric Co., York, Pa., told how leaving things to chance results in failure.

H. A. Bergdahl, Crane Co., Chicago, in his talk entitled "A Bonus Every Month" reiterated the theme of sales meetings: "Sell benefits."

During the panel discussion, three members gave their firms' positions on the distributor as a specialist, as a full-line house, and as a full-line house handling allied products.

The specialists' viewpoint was taken by R. J. Farr, Welding Sales & Engineering Co., Detroit. Willard Stewart, Sanders and Stewart, Jackson, Mich., presented the stand of the distributor who operates his business as a full-line welding supply house. William Hart, Valley Welding Supply, Inc., Appleton, Wis., told how his firm took on allied lines for the convenience of its customers.

Still A Moot Point

Although presenting the varying viewpoints, the discussion did not settle the moot point: "which is the best type of welding supply house from a profit and service standpoint?" Nor was it intended to . . . for that argument will continue as long as there are distributors.

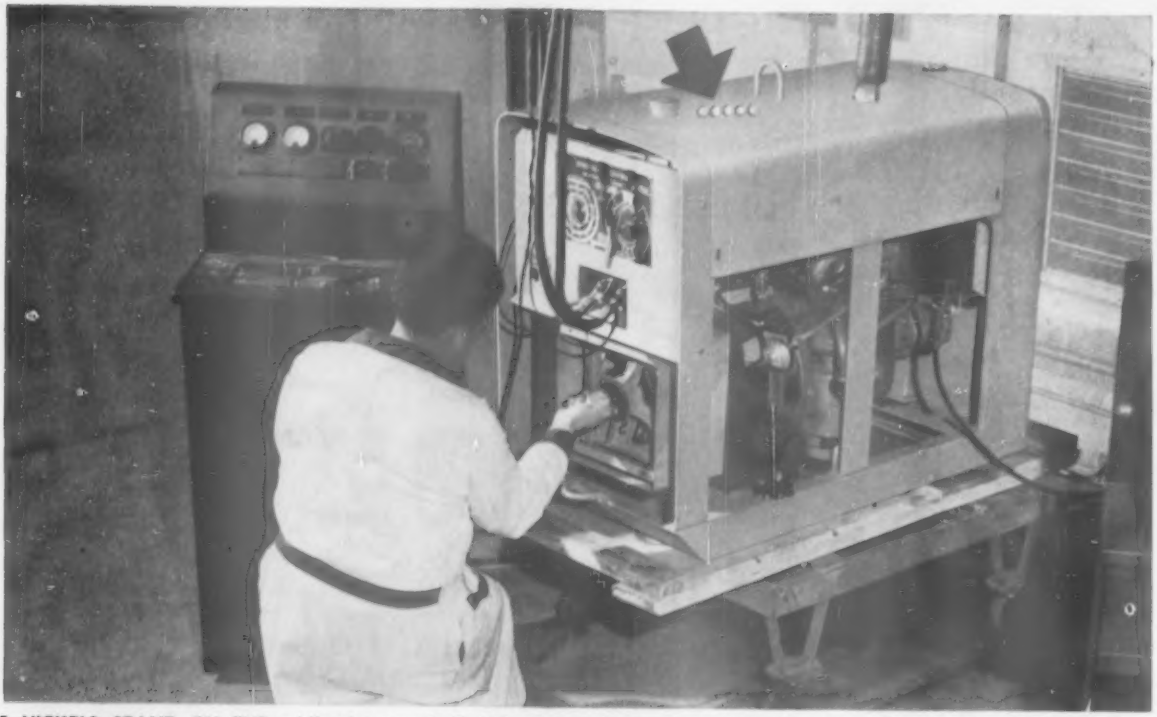
The importance of the credit manager and his role in our changing economy was the topic of a talk by E. B. Moran, National Association of Credit Men, New York City. The credit managers' role: to expedite the turnover of a company's working capital, just as it is the sales manager's task to expedite the turnover of the firm's inventory.

Mr. Moran stated that for every increase in the turnover of capital, there is an increase in dividends.

The Grand Rapids program included a talk by an officer of a mill supply house. Arthur D. Grover, Grand Rapids Supply Co., described his sales training program.

Budget and budget control were topics of P. R. Clark, Conner & Clark, Cleveland. Larman Abbott, George & Dix, Grand Rapids, discussed employe selection and development, and Charles W. LaBlanc, Research Institute of America, New York City, completed the two-day program with a relaxed version of a talk on tension and how to beat it.

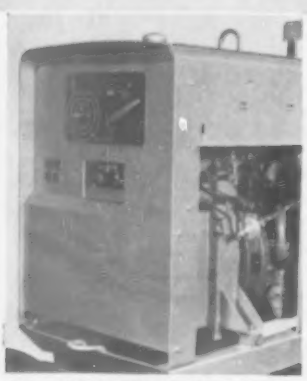
NOW! Steady Output



5 NICKELS STAND ON END while the new G-E 200-amp welder runs at full load. This unusually steady operation demonstrates the advanced engineering thought which makes the G-E engine-drive welder your best performance buy.

PROVE IT TO YOURSELF— Make this actual feature-by-feature comparison of the new 200-amp G-E engine-drive welder with two other welders of the same rating. You will see that only the new G-E welder has so many advanced design features for better welding performance at lower cost.

ELECTRODE SELECTOR, CURRENT DIAL—Dual controls simplify current control, give you easier, more accurate adjustment.



NON-PROJECTING GENERATOR—No vital parts are exposed. Full-length base encloses generator for rugged in-the-field welding.

PUSHER ENGINE FAN—Air is blown out of radiator, helping to prevent vapor lock.

GENERAL ELECTRIC	✓	✓	✓
MANUFACTURER A			✓
MANUFACTURER B			

Hour After Hour, at Full Load

...WITH GENERAL ELECTRIC'S ALL NEW 200-AMP ENGINE-DRIVE WELDER

General Electric's new 200-amp engine-drive welder eliminates one of the welding operator's common complaints—excessive loss of amperage and arc heat when operating the welder at full load for a sustained period.

This powerful welder is equipped with a direct-connected Hercules engine and specially designed generator. This combination maintains steady output and 100% arc stability—hour after hour—even when operated above full load. And no matter what type or size of electrode you use, or where you set the controls, this G-E welder provides complete freedom from "pop-outs." This is due to the high recovery voltage of the welder.

Six months of rigorous in-the-field testing by 18 pipeline welding operators has already proved that the new G-E engine-drive welder has that extra punch needed for top performance in job shops, on construction, and similar welding operations.

Only the new G-E welder has so many features that assure superior welding. With "rugged simplicity" built in, the G-E welder has fewer parts, sturdier construction for longer life.

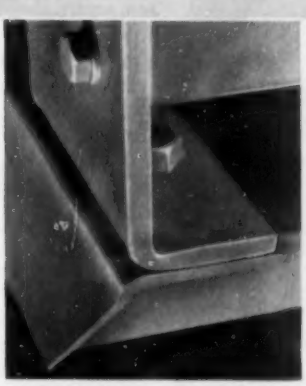
Check below to see how this welder compares with other make welders, feature by feature. Then make your own test.

For more information, write for bulletin GEC-1333, Section 714-1, General Electric Company, Schenectady 5, New York, or contact your nearby G-E Welding Distributor. He's listed in the yellow pages of your phone book. And ask him also about General Electric's new special electrodes for construction—W-610A and W-710A. 714-1

Progress Is Our Most Important Product

GENERAL ELECTRIC

CONSTANT PRESSURE BRUSH SPRINGS—New feature eliminates need for adjustment.



HEAVY-GAUGE METAL THROUGHOUT—16-gauge canopy, 3/16-in. channels, 1/4-in. cross bars withstand rough field conditions.

OVER 12-HOUR OPERATION—New slowdown control and 17-gallon tank give more than one shift operation on a tank of gas.

SPRING-WOUND TRAILER AXLE—New construction of axle reduces side sway and weaving for easier towing, better tracking.

OXYACETYLENE torch is used by laundry maintenance weldor to join L-plates for flanged replacement.

GARAGE mechanic uses acetylene torch to apply solder to worn area of truck body.

Maintenance welding in service industries — No. 2

A laundry needs welding

BY JEROME SHAFFER

MAINTAINING continuous operations is a necessity in the laundry industry, and welding plays an important role in fulfilling this need. Whether it be a sorting pin or a delivery truck that breaks down, welding has been found to be the most efficient method for repair.

One laundry owner stated flatly that it would be impossible to maintain his equipment without welding.

"Naturally, it's much less expensive than buying new material," he said, "and there's no question about the long service life a good weld will give."

Another laundryman who owns his own firm and uses welding in his maintenance operations said that, if welding is to be used at all, a laundry should own its own equipment and employ a weldor.

"Most jobs are small ones, and we're on a tight time schedule," he observed, "so calling in a professional weldor would be a pretty uneconomical way of handling these repairs."

TACK-welded frame will be used to hold large bin in laundry work area.

Common Applications

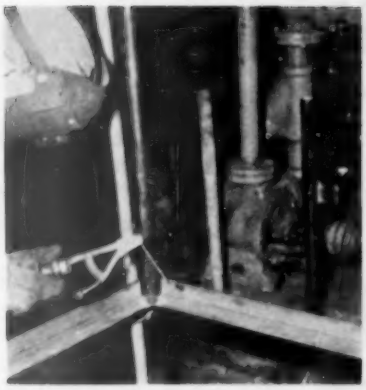
Although it is true that most laundry repair jobs are small ones, they offer the weldor wide variety of welding methods and applications.

An oxyacetylene welder, for instance, will be used to repair steam and return lines which send steam to pressing machines and return it as water to the point of origin.

If "lint houses" on the laundry roof need mending, an arc welder is put into operation. When 3-in. pipes carrying softened water into the washing machines spring a leak, the weldor calls on the oxyacetylene torch.

Oxyacetylene is used also when repair-welding parts from stokers and boiler grates, and steel and iron castings on washing machines. Electric welding is employed on break downs on the hand-trucks which carry laundry bundles and nets from one section of a plant to another. Also, it can weld conveyor belts and tables on which clothes are sorted and packed.

Both the North Chicago and the Pilgrim laundries, on Chicago's northwest side, have been using welding in maintenance work for many years. The North Chicago firm uses



ARC welding is used to join light metal frame for table shown below.

both an oxyacetylene and an a-c arc welder.

The Pilgrim Laundry, which has employed an oxyacetylene unit for some time, recently purchased an all-purpose arc welder which uses both a-c and d-c, straight or reverse polarity. The new welder has a 160-amp capacity.

Welding Labor Force

Neither laundry employs a full-time weldor. At Pilgrim, however, two maintenance engineers are qualified to handle all welding work.

Three engineers with a working knowledge of welding keep equipment in top shape at North Chicago Laundry. Welded repairs on trucks usually are handled by a mechanic.

Engineers at both firms had no previous welding experience or training. The men feel, however, that their trial-and-error education with torch and electrode has provided them with all the benefits of formal instruction.

One engineer, obviously a welding devotee, told of a trend he has observed just in the past few years.

"When we first used welding," he said, "the repairs were considered temporary. Parts were welded and put back into service until replacement parts arrived.

Weld Appearance

"*But*," he grinned, "that was before we knew the full story on the true strength of a weld. Those replacements would arrive and be installed. In a short time, they'd break, too, and the welded part would be put back into service again.

"Believe me, it didn't take management long to see where economy lay—with welding!"

Another important factor cited by both laundries was the neat appearance of a welded repair, particularly on delivery trucks. Truck bodies that are rusted or damaged in accidents can be welded, repainted and sent back on the road looking as good as new—a vital consideration for the only public representation a laundry may have outside the cleaning plant.

Choose E6013's

Both firms give E6013 electrodes wide usage, with E6011's running a sometimes close second. All welding engineers in the laundry plants agree that the ⅛-in.-diameter electrode is the size most applicable on common jobs.

The downhand position is used most frequently in welding repairs at both laundries. Work may be done on the floor or in the welding shop, but at the Pilgrim Laundry weldors prefer removal of work to the shop to avoid interfering with other plant operations.

This situation is reversed at the North Chicago Laundry, where weldors would rather make their welds "on the spot" wherever possible. At this firm, also, a hardfacing application is made on cast iron and steel parts used in pressing equipment, giving additional service life.

But whatever their differences in actual operations or techniques may be, both laundries agree on this: welding has proved itself a great time and cost-saver for practically every maintenance problem in the laundry business.

PACKING table is fabricated entirely by welding, giving it greater strength.

NOW — find the answers to your WELDING PROBLEMS *faster!*

Here, complete in one volume, are all welding fundamentals and practical working techniques — arranged alphabetically for speedy reference.

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This working guide for all welding applications in all industries is a must for engineers, designers, supervisors, foremen, and weldors. Over 2000 subjects—in alphabetical order and cross-referenced throughout—put the facts you want at your fingertips. It covers all phases of welding, cutting, flame treating, etc., as well as problems of production, repair, and maintenance. Handy tables and charts . . . dictionary of trade names . . . buyers' manual—all go to make this a vital guide wherever welding is used.

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JIMMY Vito and one of his weldors inspect the start of another job—attaching wear-plates to the bottom of a coal bucket. Electrode is an E7016.

Coal bucket welds

BY WALTER E. PALMER

The Champion Rivet Co.

PROBABLY no one is more capable of keeping "black diamond" buckets in good shape than Jimmy Vito and his master weldors of Hazleton, Pa., in the heart of the coal country.

Practically every bucket within 50 miles of Hazleton has been repaired or rebuilt by the Vito crew. These weldors work in both shop and field to maintain material necessary for consistent production of that very important element known as coal.

The full range of bucket sizes treated in the Vito shop runs between the ¾-yd and 10-yd size, though many 25-yd-capacity buckets are repaired in the field.

The type of work called for may vary from welding broken parts and cracks to the welding of wear-plates and hardfacing. The use of several hundreds of pounds of electrodes per bucket is not unusual.

CRACKS in coal buckets are repaired with E7016 or nickel-manganese electrodes, depending upon location.

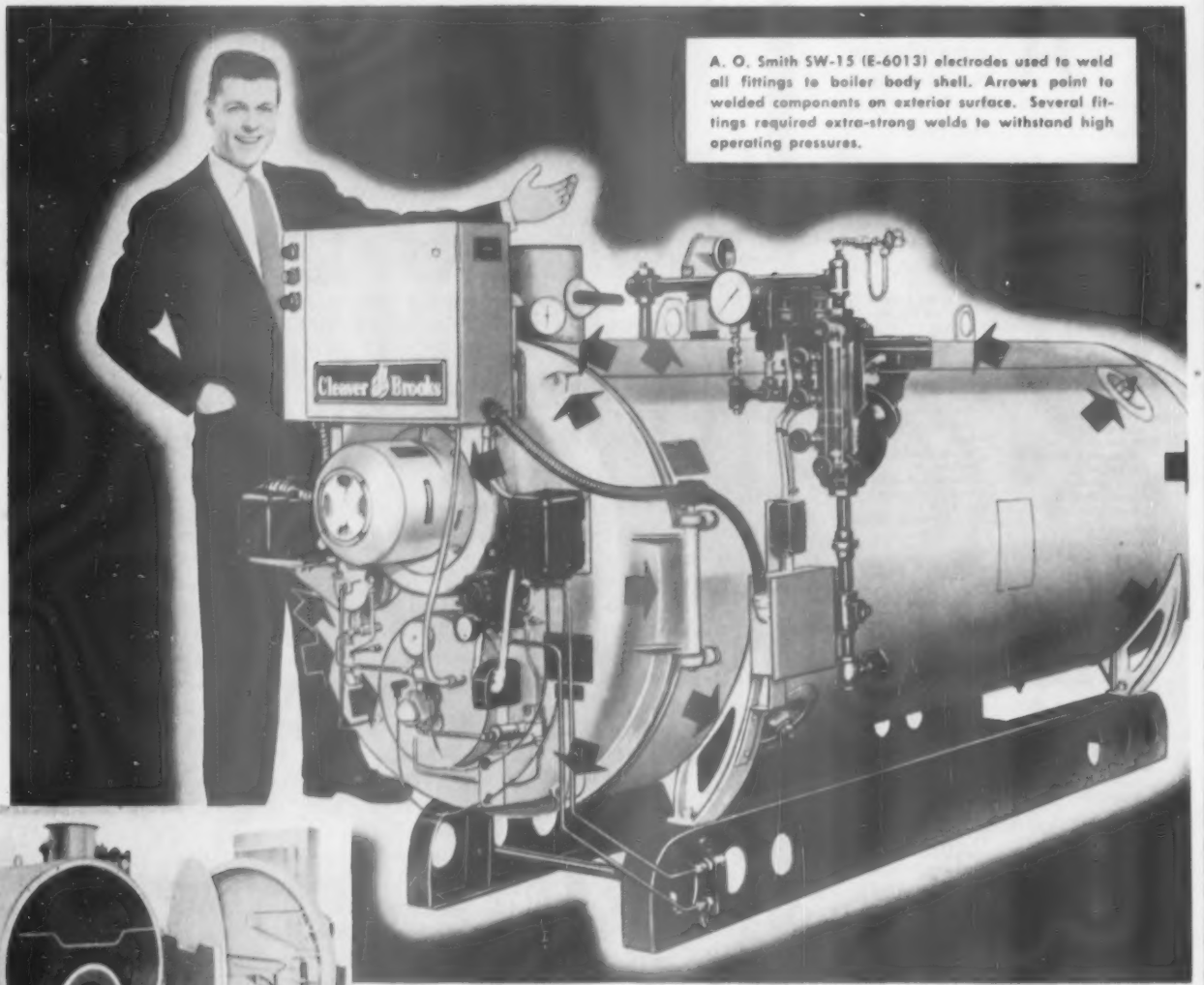
Both bare and coated nickel-manganese electrodes play an important part in the welding operation when "teeth" are replaced, or when cracks are repaired in these buckets. As many as five buckets at a time may be under repair in the Vito shop on Cedar St.

Recently, two new rod types have been given increasing use by Vito and his weldors. The first, an E7016, low-alloy, high-tensile electrode, replaces a stainless electrode for welding cracks in manganese. It is also used for attaching manganese wear-plates or bars to the buckets, and for reclaiming worn areas for further hardfacing.

Where the E7016 rod is used, actually, on 50% of the shop's work, no peening is necessary. This helps cut labor time that can more profitably be applied to hardfacing. In this manner, Vito actually gives his customers more resistant-to-wear material on buckets at a cost no greater than the total charge for repairs using the stainless steel electrode.

A new, high-speed rod for use in manganese and carbon steel hardfacing is the second welding rod type now in use in the Vito shop. It deposits with the speed of a coated, mild-steel iron rod type, and thus provides additional savings in labor costs. These savings are again reflected in the increased hardfacing of coal buckets.

For their NEW "packaged" boiler Cleaver-Brooks



A. O. Smith SW-15 (E-6013) electrodes used to weld all fittings to boiler body shell. Arrows point to welded components on exterior surface. Several fittings required extra-strong welds to withstand high operating pressures.

A. O. Smith SW-44 (iron powder) electrodes used in welding flanges on front head (top) and rear door assemblies. Because slag peels as they weld, SW-44 electrodes virtually eliminate clean-ups.

America's top-line welding electrodes!

SW-15

Rated as the world's finest high-production electrode. Working range extends from light gauge to heavy plate. High heat and speeds can be used without risk of undercut. Operates with a quiet, even, smooth arc of medium penetration.

SW-44

A self-cleaning iron powder electrode. Ideal for all jobs in AWS Class E-6012, this weld-rod lets you deposit far more weld metal than conventional electrodes in its class. Easy re-striking — even when rod is cold.

chooses A. O. Smith electrodes for

all manual welds

A. O. Smith SW-15 and SW-44 weld-rods used for production welding of Cleaver-Brooks new "packaged" boilers

WHEN Cleaver-Brooks started production of its new, streamlined CB boilers, they selected A. O. Smith electrodes to obtain excellent welds that could meet production economies without sacrificing quality. Welds must, of course, be perfect to withstand 1½ times their design pressures, and actually they test out far in excess of ASME code requirements.

These new boilers are the result of nearly 25 years of design and manufacturing experience. Only the finest materials are used. That's why Cleaver-Brooks' engineers insisted on the A. O. Smith SW-15 electrode that produces an easily-controlled, forceful arc with deep penetration in all positions. They also specified the SW-44 iron powder electrode that's so easy to use and produces excellent beads — flawlessly smooth and practically self-cleaning.

If your products demand quality welds every time, it will pay you to buy A. O. Smith electrodes. Call your A. O. Smith distributor today, or write A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wisconsin.

The man from A. O. Smith

Roy Norton is the A. O. Smith Distributor who services the Cleaver-Brooks account. He's not only a salesman, but a welding specialist who is glad to help you with your welding problems.

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Because welding is our full-time business, we offer you America's finest welder-proved electrodes, machines and accessories.

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Titanium fire hazards explained by survey

THE following article contains excerpts from a report on titanium by American Welding and Mfg. Co., Warren, Ohio:

Titanium, one of the new so-called "wonder metals," has been and continues to be a subject of great research by industry and the government. It offers many advantages yet it poses many technical problems.

Due to extreme fire hazards, a comprehensive survey was made of titanium manufacturers, fabricators, and the Bureau of Mines, to assemble as much information about titanium and its hazards as possible.

As a fine powder, titanium (somewhat like coal dust, flour dust and even house dust) is explosive and may ignite spontaneously if dispersed in air. Small particles, such as are obtained in sawing operations, ignite easily and burn with brilliant incandescence.

Fine turnings which result from the fine finishing machine cuts can be ignited by a match. Coarse turnings and chips are less dangerous. At red heat (1,300 F) titanium decomposes steam to free hydrogen, and above 1,475 F, titanium burns readily in atmospheres of pure nitrogen.

Water Ineffective

Ordinary extinguishing agents are ineffective on burning titanium. Water simply accelerates the burning rate and offers the possibility of hydrogen explosions. Water should be applied only to the surrounding structure and to the edges of the fire to cool the unignited material below the ignition point.

Foam is without value since it is largely water. Carbon tetrachloride and dry chemical extinguishers seem unsuitable, as does carbon dioxide.

Some fires can probably be handled by covering with approved dry compound extinguishing powder or absolutely dry sand in the manner of magnesium fires.

Argon or helium gases, to be effective on titanium fires, must displace virtually all the air. They can be used, it seems, only in closed containers, and are expected to be effective in fires involving titanium chips or dried sludge.

The close control needed to produce castings of satisfactory quality of itself tends to minimize the fire hazard of the operation.

Some basic recommendations:

When machining titanium, the heat conductivity of the metal is such that, if heavy tool cuts are taken, both work and tool become very hot and may ignite oil type cutting lubricants. Drilling and tapping may cause overheating.

Water or water-base coolants should be used for all machining operations with titanium to provide ample coolant supply and keep the working tool cool. CO_2 can be used as a coolant. This also applies to drilling and tapping which may cause overheating.

Remove Particles

Turnings and metal particles should be removed frequently and placed in covered metal containers. When these containers are about half full, they should be removed promptly to an isolated location.

Cutting tools should be specially designed for titanium and kept sharp to facilitate cutting and minimize heat developed.

When sawing or grinding titanium, dust and particles are produced that are subject to ready ignition causing a serious fire and explosion hazard.

In dry grinding the particles seem to oxidize and become inert. Dry grinding should be done with frequent stops.

Titanium sludge from wet grinding or machining operations should not be permitted to dry out before it is removed to an isolated outdoor site.

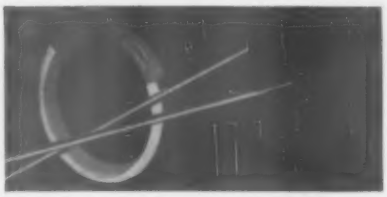
Forging, rolling and heat treating operations present only a moderate fire hazard. However, care must be taken to avoid contact with iron oxide at high temperatures.

The handling of titanium powder is one of the most hazardous phases of working with the new metal. Finely divided titanium powder should always be stored in a cool, ventilated area away from areas of acute fire hazard, open flame, and powerful oxidizing agents.

When used industrially, care must be taken to provide good ventilation so that the concentration of dust in the air does not build up to possible explosive proportions.

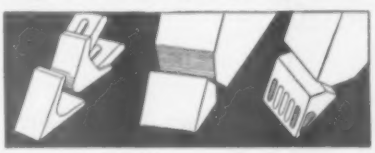
Many of the titanium compounds such as titanium dichloride, titanium tetrachloride and titanium trichloride must be handled with extreme care.

THE AMSCO® HARDFACING LINE IS COMPLETE . . .

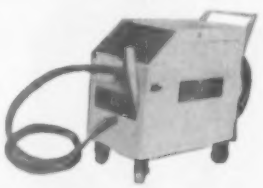


Hardfacing Rods and Electrodes . . . A complete line of manual and automatic build-up and hardfacing materials. One for every repair job. Amsco rods and electrodes contain alloys of the toughest, hardest metals known including manganese steel.

Automatic Welders . . . The Amsco-Leader line of welders permits fully automatic build-up and hardfacing, especially in fields using heavy-duty equipment. Welding positioners and power unit included in package.



Amsco Repointers . . . Add the long wearing quality of manganese steel to digging equipment. All you do is weld them on. Available also are rounds, squares, flats, plate, grouser bars, electrodes—all made of manganese steel.



Semi-automatic MF Welder . . . Uses entirely new principle of magnetic flux welding that permits you to step up weld deposit rate, increase welding speed during hardfacing or build-up. Welders connect to any standard AC or DC welding machine.

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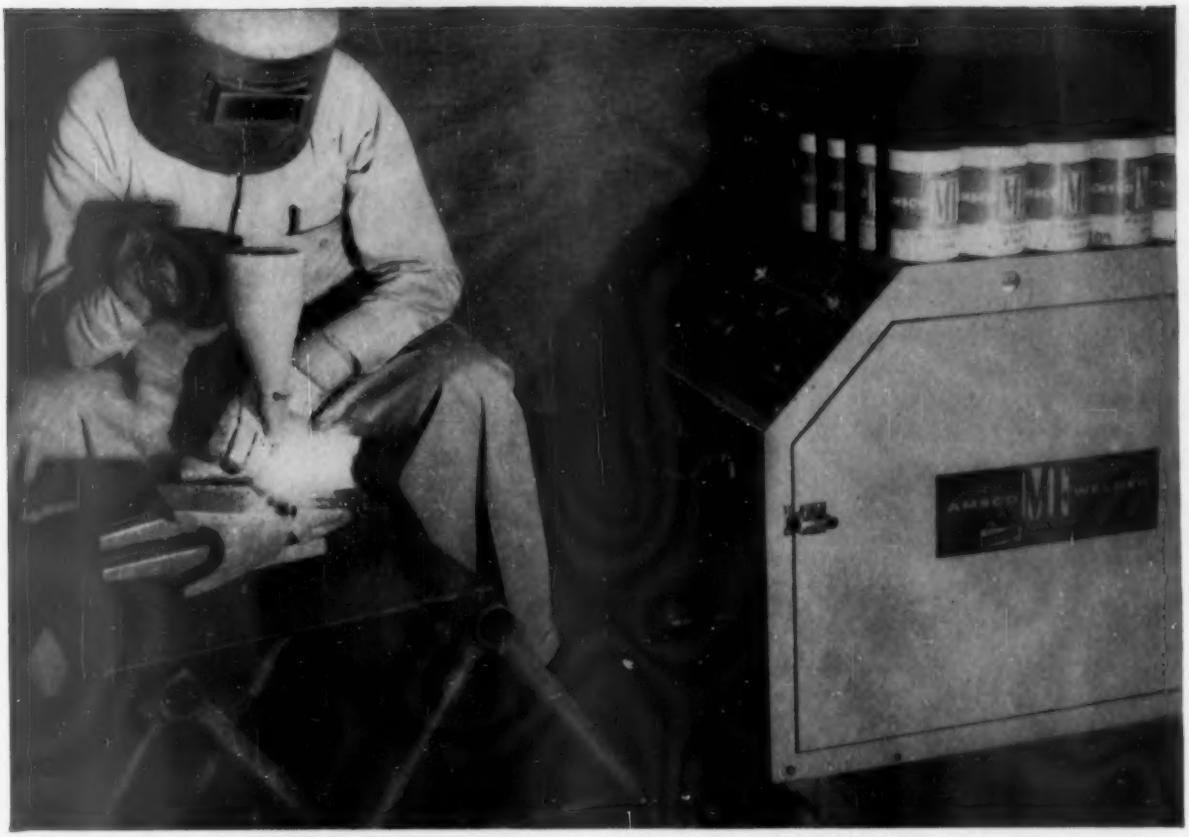
Chicago Hts., Illinois



Welder is shown welding a "wear-sharp" repointer to the shank of a dipper tooth using the Amsco MF and flux.

HARDFACE WITH THE AMSCO® MF

for manual flexibility . . . plus machine speed and accuracy

The Amsco MF combines the visibility and craftsmanship of hand welding with the automatic advantages of machine work. Speed of hardfacing increases because the Amsco MF uses small-diameter electrode and high-current densities which allow the operator to maintain a high deposit rate. The electrode feed is continuous—and automatically regulated—to maintain a constant arc. Thus, the machine automatically *compensates* for operator movement or an irregular welding surface.

Cost of deposited metal is less! The Amsco MF uses coiled, bare mild steel electrode. It feeds through the flux hopper (the cone). There it is magnetically coated with your choice of manganese steel build-up or hardfacing alloy which is carried in the flux. You coat your electrode as you weld at considerable savings in deposit cost.

The machine is portable. It plugs into any standard welding unit, and requires no special setup. See a demonstration of the Amsco MF's speed, quality of weld and uniform deposit. Try it yourself and discover how easy it is to operate. Your Amsco Distributor is ready to show it to you now. Welding products are distributed in Canada by Canadian Liquid Air Co., Ltd.

make your Amsco Distributor HARDFACING HEADQUARTERS

AMERICAN Brake Shoe COMPANY

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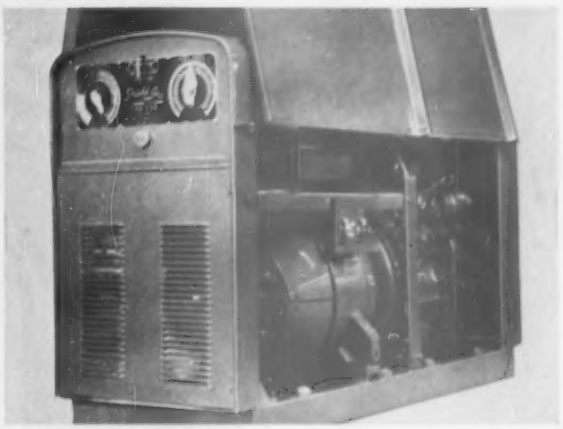
Chicago Heights, Ill.

new products . . . . . USE CARD ON PAGE 97



ECONOMICAL welder features continuous control of arc type and intensity. It is diesel-powered.

INSPECTION unit uses gamma rays to examine welds, requiring no electricity, and at no danger to operator.

Welder

DIESEL powered welder is for construction, pipe line and structural welding. Termed the "Shield-Arc SAE-250," the unit is rated 250 amp at 40 volts, 60% continuous duty cycle.

Arc can be controlled as to type, as well as intensity, to permit efficient welding in all positions and varying conditions. Range is from 50 to 250 amp, using electrodes from 1/16 to 1/4 in. diameter. Welding generator provides 115 volts, d-c auxiliary power for tools and lights. Welder is powered by a four-cylinder, four-cycle engine, rated at 39 hp at 1,700 rpm. *The Lincoln Electric Co.*

Circle No. 1.

* * *

Welding control

NEW line of resistance-welding controls features printed circuits and a weld-safe circuit for protection of equipment and work in process.

The weld timer and sequencing circuit are designed to lock out welding current in event of tube failure. All component locations and ratings are printed on panel front. Ignitron tubes are protected by a thermostatic switch snap-mounted on the outer water jacket. *Westinghouse Electric Corp.*

Circle No. 2.

* * *

Welding wire

FABRICATED welding wire is for automatic and semiautomatic hardfacing. Termed "Wear-O-Matic," it is a dense, controlled-diameter wire. Wire is said to have a uniform compactness for uniform chemistry and hardness. Precision-drawn to provide a smooth feed with any automatic head (without use of special feed rolls or contact tubes), wire is electroplated with copper. The copper prevents surface rust and insures positive electrical contact. *Drawalloy Corp.*

Circle No. 3.

* * *

Electrode

NEW hardfacing electrode is for use where high corrosion and abrasion are met at elevated temperatures. Termed "Mir-O-Col No. 11," the electrode is claimed to retain its characteristics at red heat. It is claimed to produce a smooth, bright, non-oxidized deposit, free from any porosity.

This electrode is a high-cast alloy rod of the non-ferrous type. Due to its high hardness, it is recommended where only moderate impact is encountered. *Mir-O-Col Alloy Co.*

Circle No. 4.

* * *

Weld tester

SPOT weld tester examines weld by exposing weld nugget. Termed "Peel-Quick," the tester will test welds in metals up to 10 gage. It can be altered to suit odd sizes or special weld patterns.

A coupon, of the gages used, is placed in the holder locator and a test spot weld made. The welded coupon is then placed in a vise and the clamp tightened. The handle, when rotated, peels the coupons apart, showing the weld nugget size. Use of this method is fast and will reduce use of production parts for test purposes, states manufacturer. *Industrial Welding Services.*

Circle No. 5.

Inspection tool

PORTABLE gamma ray projector is for radiographic inspection. Termed "Kel-Ray," the projector is safe to operate, needs no electricity or control board, and requires no maintenance beyond replenishment of the radioisotope, states manufacturer. It can take a 360-deg exposure.

Unit is shielded with lead, thickness of its walls depending on strength of isotope to be used. It has a lenseless shutter that can be opened and closed remotely. Projector (made by M. W. Kellogg Co.) is available in three sizes—75, 250 and 2,900 lb. *Metal & Thermit Corp.*

Circle No. 6.

* * *

Torch lighter

"TIME-SAVER" automatic electric torch lighter operates only when used. It is said to use very little electricity. Unit is contained in a steel case, 4½ by 5 by 6½ in., with attached cord and plug ready to insert into any 110-volt a-c outlet. It leaves both hands free to operate the torch. Torch is lit by opening gas valve and laying tip across operating lever. *Ellison Mfg.*

Circle No. 7.

* * *

Clamp

ADJUSTABLE work holder holds two parts at any angle. The tool's two clamping faces are adjustable from 0 through 180 deg, and are precision-machined for alignment. Adjustments are made by loosening the single machine handle and moving the indicator to the desired angle. Tool is made of cast aluminum alloy. *Jergens Tool Specialty Co.*

Circle No. 8.

NO SINGLE WELDER WILL DO IT ALL!

THERE'S EXACTLY
THE RIGHT **miller** WELDER
TO MEET EVERY WELDING REQUIREMENT

MILLER SR RECTIFIER TYPE DC ARC WELDERS

Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitran transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.

THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.

THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding—as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

Write today for complete information on these Miller Welders.

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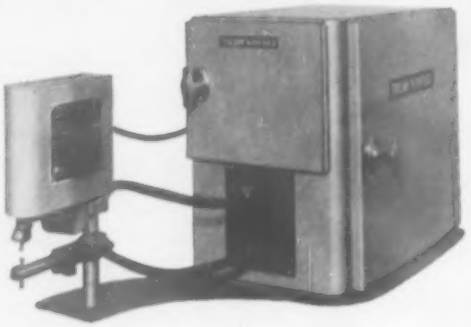
P.O. Box 798 Appleton, Wisconsin

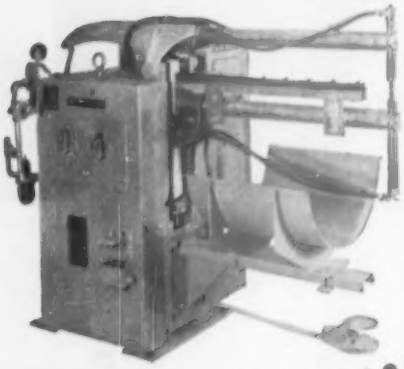
"... if it's MILLER you know it's the finest..."

STANDARD ★ MODIFIED ★
SPECIAL RESISTANCE WELDERS

Standard Resistance Welder

Efficient for all basic uses; low operating cost, prompt delivery, long service.



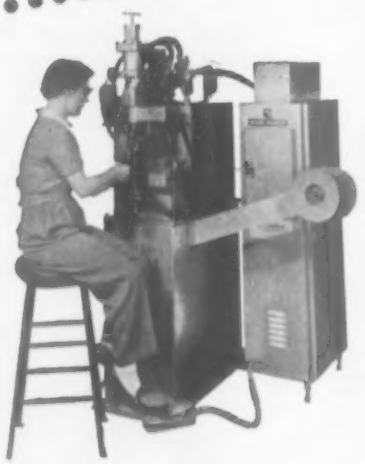


Standard Resistance Welder With Special Tooling

Modified to suit your requirements; increased production, low cost retooling.

Special Resistance Welder

Built for your specific needs; mass production of special products at lowest cost per unit.



Resistance Welders Since 1898

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TAYLOR-WINFIELD
RESISTANCE WELDERS
SPOT • PROJECTION • SEAM • FLASH-BUTT

THE TAYLOR-WINFIELD CORPORATION WARREN, OHIO

Welder

UTILITY welder is designed for all-purpose welding. Model "31" will enable operator to produce effective cutting, brazing and high strength welding in aluminum, manganese, cast iron.

An a-c, 230-115 volt, arc welder, unit is supplied with 8-ft. flexible power cable, ground clamp and cable, electrode holder and cable, hand shield with lens, assortment of welding electrodes and instruction book. Model has six heat ranges with a 100-amp maximum output. Welder uses electrodes up to 1/8 in. Unit is 18 in. high, 10 in. wide and 12¾ in. deep and weighs 85 lb. *Marquette Mfg. Co.*

Circle No. 9.

* * *

Brazing alloy

"NICROBRAZ" paste is for brazing applications involving stainless steels, nickel-base, cobalt-base, and similar alloys. It produces a heat and corrosion resistant brazed joint, providing a thin overlay in the area surrounding the joint, states manufacturer.

Paste is easily applied by brushing, dipping or any other type of hand or mechanical application when properly diluted for the method used. Paste comes in 2, 4, 8 oz. and 1 and 5 lb. glass containers. *Wall Colmonoy Corp.*

Circle No. 10.

* * *

Fittings

LINE of instrumentation fittings, made of unplasticized polyvinyl chloride, are especially useful where corrosive atmospheres exist. Corrosion resistant flexible tubing is available for use with the fittings.

Fittings can be employed in instrumentation of chemical plants, hospitals and similar activities. An entire assembly can be put together by hand, it is claimed, without aid of wrenches. Tubing needs only to be cut to proper length. Fittings and tubing are available in 1/4 and 3/8 in. sizes. *Tube Turns Plastics, Inc.*

Circle No. 11.

For nearly thirty years, the Henry Pratt Company of Chicago has specialized in the designing and building of many types of butterfly valves. The fabricated body shell illustrated above is an example of an unusual butterfly valve made for an unusual service. Installed in a closed-circuit controlled-atmosphere wind tunnel, this Stressed Seal* Butterfly Valve must withstand transonic velocity air streams at temperatures ranging from —100°F. to +650°F.

*Copyright Henry Pratt Co.

HENRY PRATT COMPANY welds 3½% Nickel Steel in half the time with ATOM·ARC 8016N IRON POWDER LOW HYDROGEN ELECTRODES

REDUCING cost approximately 50% was the remarkable result of the Henry Pratt Company, Chicago, Illinois, changing to ATOM • ARC 8016N iron powder, low hydrogen electrodes.

The Henry Pratt job was the fabrication of 66" and 48" Butterfly Valve bodies of 3½% nickel steel to be used in a closed-circuit, controlled-atmosphere wind tunnel. By using ATOM • ARC 8016N electrodes, the company eliminated costly and troublesome pre-heat procedures making available more man-hours for production welding. Easier *all-position* welding and cutting down on slag cleaning time brought greater weldor ease and comfort. The weld deposit rate was increased 30% with no appreciable spatter loss and there was no porosity or cracking of any kind in the welds.

The cost-saving experience of the Henry Pratt Company has been duplicated in plant after plant. That is why it will pay you to use ATOM • ARC . . . the *all-position*, iron powder, low hydrogen electrode.

Alloy Rods Co.

Get your free copy of this DATA SHEET on ATOM • ARC 8016N. It includes complete information on Application, Description, Identification, Physical Properties, Chemical Analyses and Welding Procedure. For your free copy write:

ALLOY RODS COMPANY

General Offices and Plant
Lincoln Highway West
YORK 2, PENNSYLVANIA

Pacific Coast Sales Offices and Plant
750 Lairport Street
EL SEGUNDO, CALIFORNIA

WELDMATIC
Model 1015

TWEEZER-TYPE
HAND-PIECE

A major advance in precision metal joining

STORED-ENERGY WELDING SPEEDS PRECISION ASSEMBLY

NEW METHOD

Welded electronic components and precision instruments (resistors, potentiometers, capacitors, transducers, etc.) show superior performance with lower production costs. All metals and most combinations joined in many shapes and thickness ratios. Milli-second weld-time permits precision welding of copper, silver, and other "difficult" materials.

STORED-ENERGY PRINCIPLE

Unitek Weldmatic equipment utilizes capacitor-discharge to make precision resistance welds. Energy stored is instantly adjustable over a very wide range to accommodate wires 0.0003 through 0.040 inch diameter and sheet metal 0.00005 to 0.020.

WELDMATIC FEATURES

Simple installation, rapid setup, versatility, easy operation, and low maintenance make the Model 1015 best for electronics assembly. Untrained operators make uniform, high-strength welds with no discoloration or deformation. Other models available for special jobs.

Write for descriptive brochure.

Unitek WELDMATIC

UNITEK CORPORATION

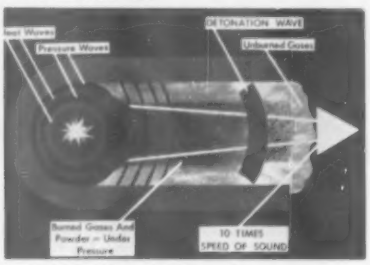
271 North Halstead
Pasadena 8, California

Welding machine

SEMIAUTOMATIC shielded-arc welding machine is designed for producing circular welds on large round assemblies up to 13-ft. long. A 19-ft. steel bed supports movable fixtures for assembly length variations.

Fixtures have a motor-driven headstock, tailstock with live centers, rest blocks for parts support during loading, and roller steady rests to support parts during welding. Air cylinders control head and tailstocks motion. Welder is 20 ft. long, 14 ft. high and 6 ft. deep. *Expert Welding Machine.*

Circle No. 12.



Tungsten carbide coating

CONTROLLED detonation is said to be the key to a unique surfacing process. "Flame-Plating" is a coating method in which particles of tungsten carbide are literally blasted onto the surface of a workpiece.

The thin coating of metal parts is done by a specially constructed gun. Ignition, by spark, of tungsten carbide powder, acetylene and oxygen, causes detonation. This force hurls tungsten carbide particles at the workpiece. Coating is accomplished by build-up and fusion of particles.

Gun barrel temperature often reaches 6,000 F, but workpiece seldom exceeds 400 F, claims manufacturer. This means precision and semiprecision parts can be coated without risking changes in properties or dimensions. Surface, after coating, looks and feels like fine emery paper. Parts may be used in this condition or finished to greater smoothness. *Linde Air Products Co.*

Circle No. 13.

For more information use card on page 97

INVINCIBLE
WELDING FLUX RECOVERY SYSTEMS

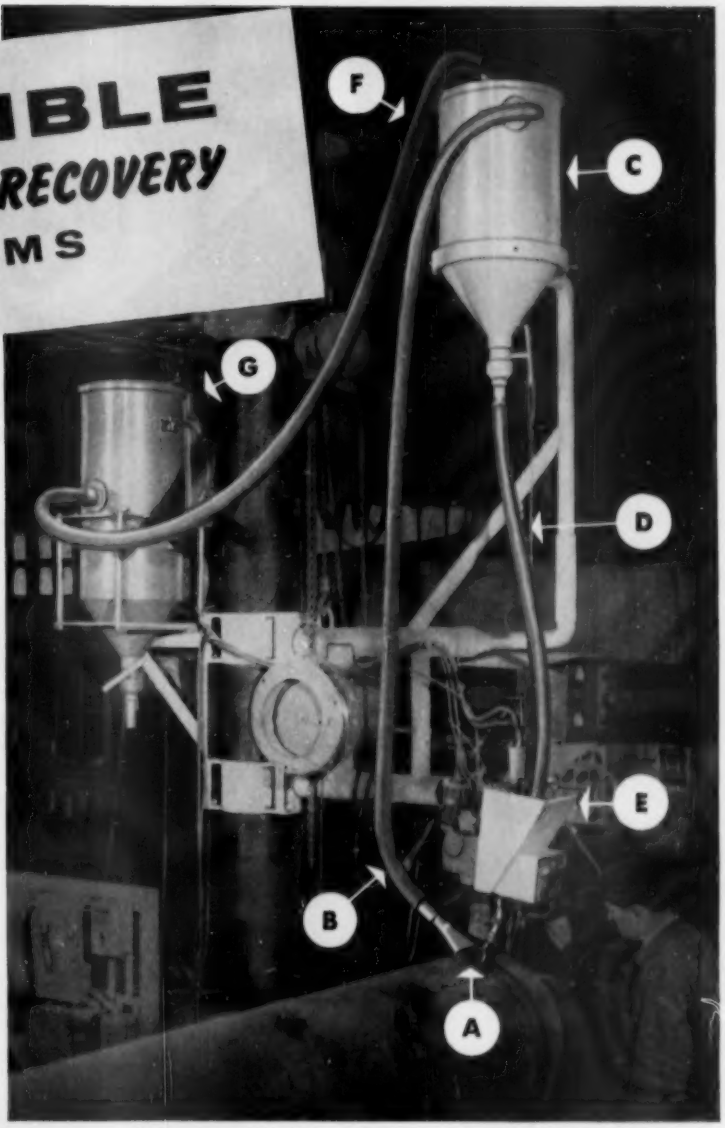


Photo courtesy of Northern Power and Industrial Piping, Ltd., Toronto

Reclaim Flux Automatically . . . Give Big Return on Investment

By using Invincible Systems on submerged arc welding jobs, one manufacturer salvages 100 pounds of flux daily; another reclaims $400 worth each day. Value of the material alone paid for the units within a few weeks.

Invincible units, like that in the photo, recover all unfused flux, remove powder and return slag-free, dust-free flux to the welder in a *continuous flow*.

Recovering flux is only part of the story. Invincibles also save costly manhours over manual methods, speed production and minimize expensive rejects by eliminating flux flour.

Invincibles are available in a wide variety of automatic and manual models. Compact, and highly flexible, they can be fitted to your specific operations, eliminating the need for costly tailor-made installations. Engineered to resist the abrasive nature of flux, Invincibles are ruggedly built for heavy-duty service.

Automatic operation of this Invincible makes possible complete recovery of unfused flux from circumferential butt weld operation. Here is how it works:

A. Nozzle draws flux up from work.

B. Recovery Hose.

C. Primary Separator separates usable flux from slag and fine dust.

D. Return Hose.

E. Flux returned into Hopper of welding head.

F. Hose connects Primary Separator (c) to Vacuum Producer (g).

G. Invincible Vacuum Producer provides vacuum for entire system and draws off the fines.

WRITE TODAY FOR FOLDER
giving full information on all types of Invincible Flux Recovery Systems.

INVINCIBLE

VACUUM CLEANER MFG. CO.
DOVER, OHIO

OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

a helping hand means... better rods for you

Welding rods with RUFLUX* in the coating offer worthwhile advantages. What these advantages can mean depends upon which RUFLUX product is used. For RUFLUX is a TAM* trade name which stands for the highest quality Rutiles, Titanates and Zirconium compounds.

A TAM sales engineer can give you the facts quickly and accurately. He is technically trained and is familiar with the properties of the various TAM RUFLUX products. Furthermore, he is supported by a well-equipped and staffed research laboratory offering every available assistance.

This combination offers you a helping hand to better welding rods.

TAM PRODUCTS
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TITANIUM ALLOY MFG. DIVISION
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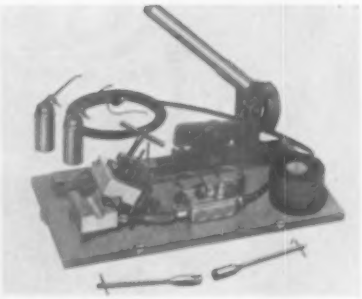
Niagara Falls, New York

*Ruflux and TAM are registered trademarks.



Cable connector

HEAVY duty, water-proof, neoprene-insulated cable connections can be made on the job or in the field, quickly and easily, states manufacturer. This new development is possible through use of a 110-volt, portable molding kit.

The kit is said to permanently seal metal connectors and electrical cables in neoprene rubber sleeves. When connectors and sleeves are interlocked, the connection is water proof and tight locking, yet may be quickly disconnected. *Industriline, Inc.*

Circle No. 14.

* * *

Spectrograph

INVERTED three-specimen spectrograph, is designed so that X-ray beams strike specimens from the bottom. It can be used in analysis of metals, powders and liquids.

The instrument has three specimen holders, 1⅜ in. diameter by 1⅜ in. deep. A knob is turned manually for changing specimen positions. An indexing device centers each specimen when over the beam. *North American Philips Co., Inc.*

Circle No. 15.

* * *

Grinding wheel

RESINOID bond "B11" is said to give more uniform structure to resinoid grinding wheels. This new bond, used with new molding and firing techniques, increases uniform spacing of abrasive grains throughout the wheel, states manufacturer. Wheels with new bond are available in wide range of hardness grades and sizes. *Norton Co.*

Circle No. 16.

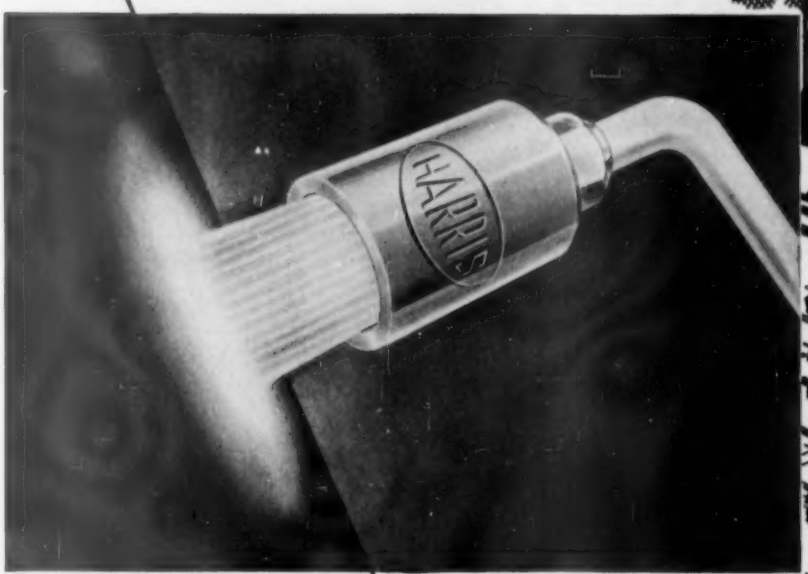
* * *

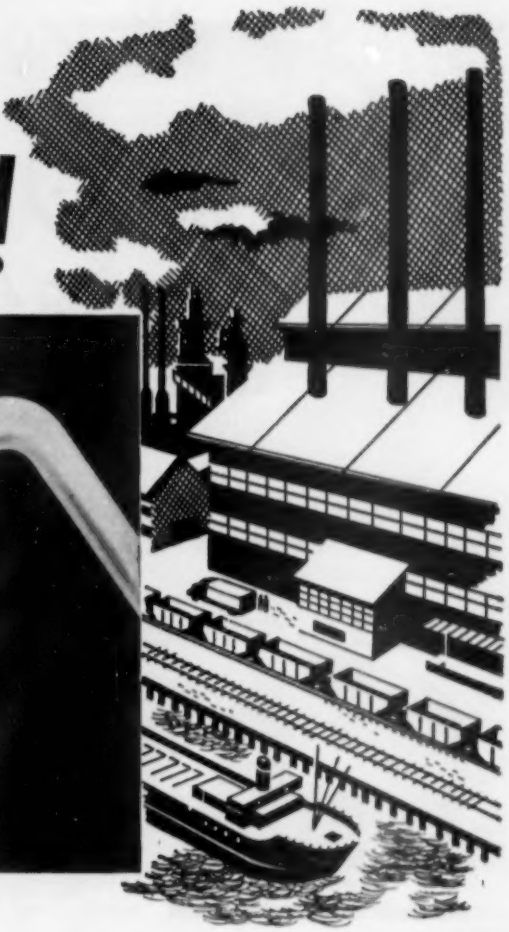
Aluminum cleaner

"ALKALUME" is a specialized deoxidizing process for preparing aluminum surfaces for welding. It is said to remove all soils and oxides without harming metal, thereby reducing surface resistance to a value of 0 to 10 microhms. The process eliminates mechanical cleaning operations and, in addition, assures more perfectly formed welds, states the manufacturer. *Northwest Chemical Co.*

Circle No. 17.

TERRIFIC HEAT !





HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.

HARRIS 1905 50 1955 ANNIVERSARY

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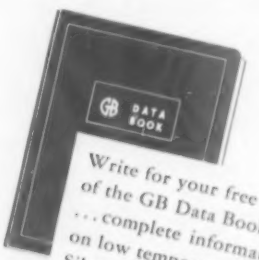
THE HARRIS CALORIFIC COMPANY
CLEVELAND 2, OHIO

for

Speed • Efficiency • Economy

...GB Silver Brazing Alloys meet all standard specifications. Available in random coils, strip, preformed rings and special shapes. This is your answer to sound, leak-proof joints on virtually any ferrous or non-ferrous metal. Silver Brazing Alloys are easy to use in production, save time, labor and assure dependable results.

GB 88 Flux, an aid in silver brazing operations, a time-tested product, assures you of maximum protection and high quality joints. Team up a GB Alloy and Flux for dependable results. Other GB Fluxes available for specialized application.



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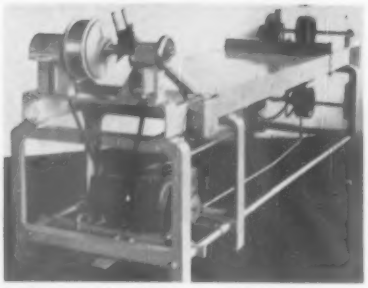

Wire winder

THIS machine is designed for precision spooling of weld wire. Termed "Micro-Spooler," it requires no gear changeovers, yet is said to provide adequate controls in level layer winding of weld wire.

Machine is ruggedly built; has a 3/4-hp drive and is capable of spooling wire from 1/32 to 1/4 in., up to speeds of 900 fpm. Unit occupies floor space of 4 by 10 ft., with center line of winding spindle at a height of 41 in. Pay-off of wire is located beside winding spindle. *Boyd & Sons Mfg. Co.*

Circle No. 18.

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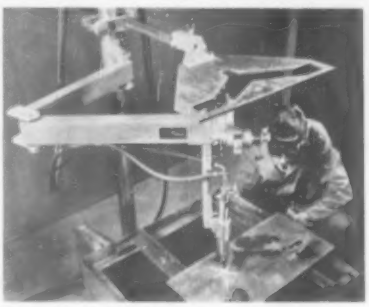


Flame cutting machine

PORTABLE flame cutting machine features a permanent magnetic roller. Termed the "No. 42 Camograph," it can cut any shape up to a 42-in. circle and straight lines to 92 in., states manufacturer.

It is an ideal tool for repetitive, accurate shape-cutting with a single torch. Machine can also serve as an auxiliary unit for larger shape-cutting machines. *Air Reduction Sales Co.*

Circle No. 19.

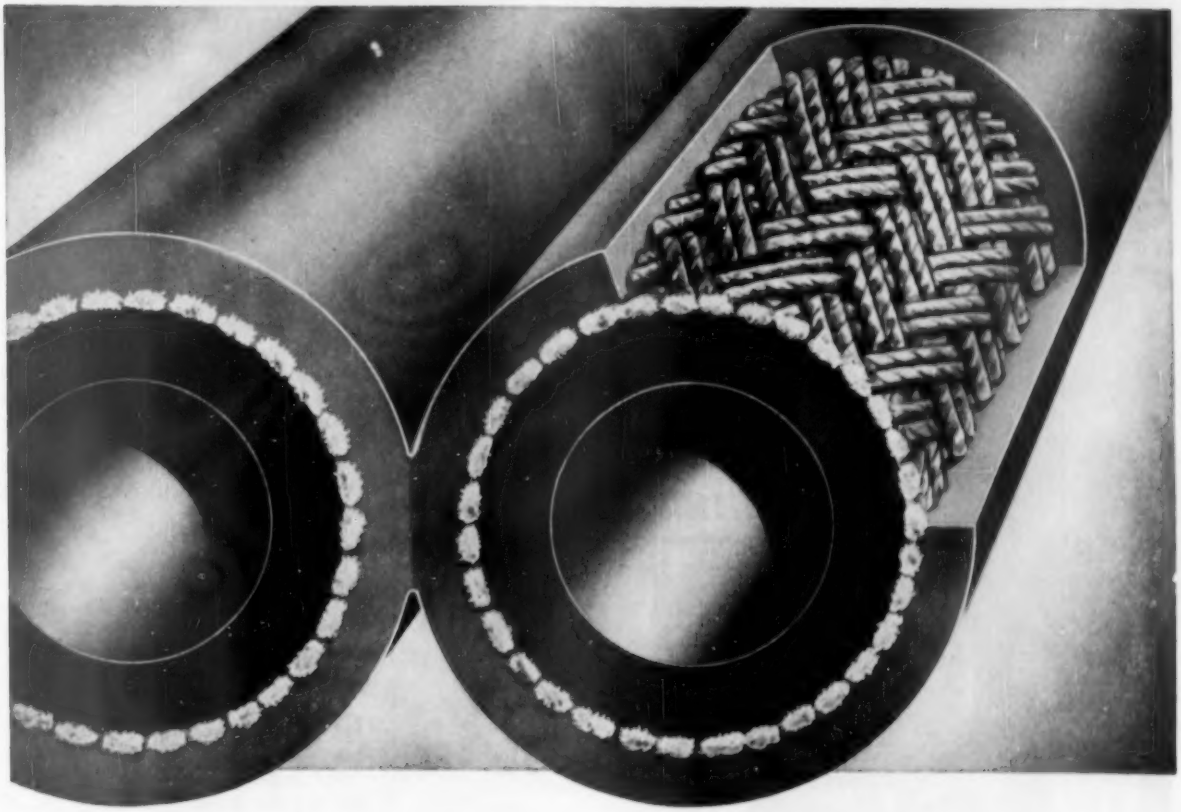
* * *

Voltage tester

THREE new high voltage "Amprobe Junior" snap-around ammeters are available. Model "300" is for general work. It covers 6 ammeter ranges up to 300 amp a-c and 3 volt meter ranges up to 600 volt. Model "600" and "1200" are multi-range units designed to handle extra-heavy loads up to 600 and 1,200 amp a-c. *Pyramid Instrument Corp.*

Circle No. 20.

TWIN-WELD . . . Now Four Ways Better



Hewitt-Robins Twin-Weld Hose Offers Values Found in No Other Welding Hose

Twin-Weld®—the original twin-line welding hose, preferred by over 7 out of 10 users—is now four ways better.

Twin-Weld is non-porous . . . it eliminates welding inefficiency, explosions and fires.

Twin-Weld has a greater ease of handling . . . eliminates tangling, assures flexibility. Twin-Weld has the important advantage of being a "straight-cure" hose; it won't snake.

Twin-Weld eliminates tangled lines. Its two lines are firmly bonded together, yet easily separated by cutting with a knife.

Twin-Weld Hose incorporates principles of construction and methods of manufacture which are exclusive with Hewitt-Robins. It is safer, longer-lasting and now has a new neoprene flame-resistant cover.

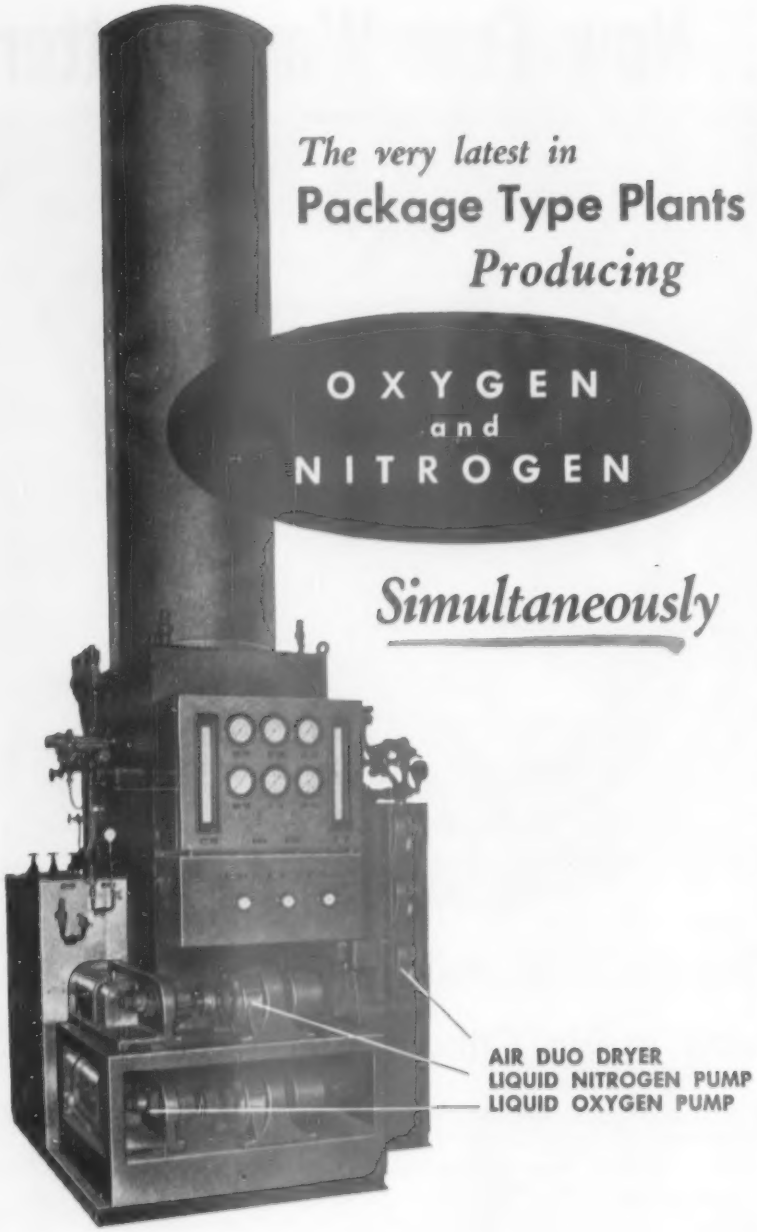
O.D.'s now conform to IAA specifications—7/16", 17/32", 19/32" . . . I.D.'s 3/16", ¼", 5/16".

Get the facts about Hewitt-Robins Twin-Weld Hose. Write for Bulletin No. H-4a. Or contact your local Hewitt Rubber Distributor (see "Rubber Products" Classified Phone Book).

Hewitt-Robins

Conveyor Belting—Conveyor Machinery—Industrial Hose—Vibrating Screens—Vibrating Conveyors—Design, Manufacture, Engineering and Erection of Complete Bulk Materials Handling Systems.

HEWITT-ROBINS INCORPORATED • STAMFORD, CONNECTICUT



With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously *increases* production 60% over the production of Oxygen alone, *plus* a corresponding reduction in the *cost* of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

We invite your inquiry.

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CONSULTING · RESEARCH · DESIGNING

CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN

O'FALLON 5, ILLINOIS

Regulator

OXYGEN regulator has a gage guard with a positive spring lock action, protecting the gage from accidental breakage. A stainless steel nipple is designed to withstand impact of accidental cylinder upset. Pressure adjustment is by means of an enclosed thrust bearing, integral with the adjusting mechanism.

All internal parts are of stainless steel; body and bonnet are forgings of aluminum alloy. Regulators are available in both single and two-stage models for oxygen, acetylene and other gases. *K-G Equipment Co., Inc.*

Circle No. 21.

* * *

Grinding wheel

LINE of cut-off wheels, called the "B7," is said to have desirable qualities for dry production metal cut-off operations. These aluminum-oxide resinoid wheels produce a faster, cooler cut because of the "B7" bond, states the manufacturer. A special process creates sharp sides on the wheels to prevent binding in the cut.

Three grades are available: "R" for minimum burn and burr operations; "T" for general purpose work where some burn and burring is acceptable, and "V" for rough work. Wheel sizes range from 6 to 20 in. diameters and 1/16, 3/32, and 1/8 in. thicknesses. *The Carborundum Co.*

Circle No. 22.

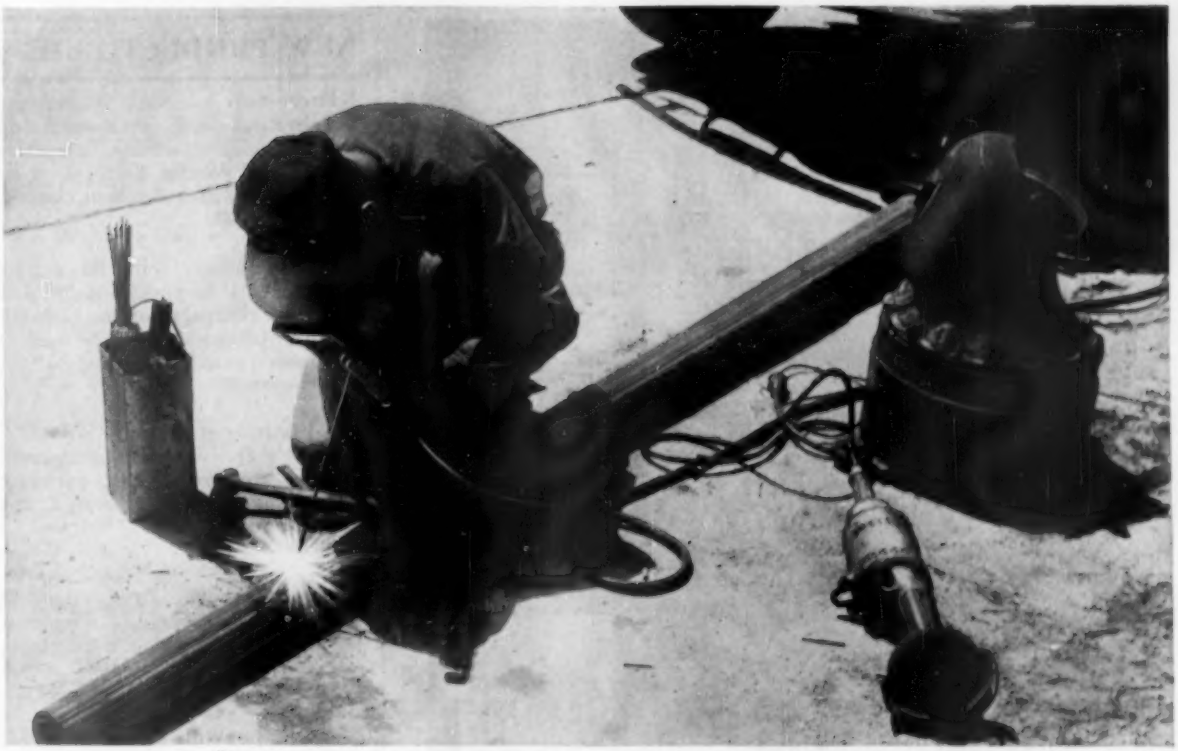
* * *

Dust collector

EFFECTIVE filtration, through its six throw-away filters, is feature of after-filtering mechanism designed for "Model 219 FM-A" cyclone-type dust collector.

Used to collect dust, lint, powders and fumes, the "219 FM-A" recirculates filtered air back into the room. Thick pads of glass insulation wool, on each of two open surfaces on the after-filter frame, remove fine dust not trapped in the collector's 4½-cu-ft capacity internal reservoir. Each filter is removable for easy replacement. *Torit Mfg. Co.*

Circle No. 23.



Knocked down—but not out

thanks to easy repair with Ni-Rod "55"

A bumper is a lamppost's worst enemy.

In the last ten years motorists have knocked down between 50 and 75 cast iron posts at Forest Hills Gardens, N. Y. — sometimes the same one several times.

New lampposts run up quite a bill at about $500 each. So the company calls in General Welding Service, Elmhurst, N. Y., to weld the posts back up. Often Forest Hills Gardens Corporation — responsible for maintenance — can't catch the guilty party.

Repairs must be fast. Breaks are usually a foot or two above the ground. Jagged metal edges and bare live wires could be dangerous to the neighborhood children.

Repairs *are* fast with easy-to-handle NI-ROD "55"* electrodes. Usually General Welding has a weldor on the spot within thirty minutes . . . and he completes the repair within two or three hours.

The average cost is under $50. The saving to the company — thousands of dollars over the years!

Where to use Ni-Rod and Ni-Rod "55" electrodes

General Welding repaired this bumper crop of lampposts with NI-ROD* electrodes until 1951 when the NI-ROD "55" electrode was introduced.

Though there is no hard and fast rule, weldors usually choose NI-ROD electrodes as their general purpose electrode for welding cast iron . . . particularly where thin sections are involved or machinability is important. They prefer NI-ROD "55" electrodes for welding heavy sections, high phosphorus irons, ductile iron, Ni-Resist* high nickel alloy cast iron, high-strength cast irons, or for joining these irons to other metals.

But here's proof that *both* electrodes give sound, strong, ductile welds. Of all the lampposts that have been knocked down again and again, *not one* has broken at the weld.

Want more proof? Send for Inco's new folder called "Repair Cast Iron Parts Quickly and Easily." It shows you some of the many castings that others have repaired successfully with NI-ROD and NI-ROD "55" electrodes.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

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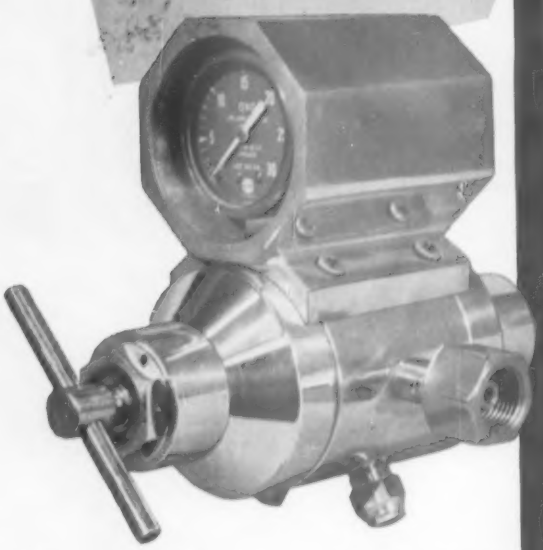
INCO

Welding Products

Electrodes
Wires
Fluxes

OXO
GAS REGULATORS
with Exclusive Patented Features



Guaranteed TO STAY IN SERVICE LONGER AND REDUCE MAINTENANCE COSTS

MANUFACTURED BY

OXO Welding Equipment Company

GENERAL OFFICE • 1235 W. 95th ST., CHICAGO 43, ILLINOIS, U.S.A.
PLANT AT NEW LENOX, ILLINOIS

OXO regulators are built under the following patents:

2,595,156 2,666,278 2,718,237 D-162,055 D-166,329 D-166,330

Dealer inquiries invited.

OXO complete catalog available upon request.

*TWECO-LITE

Send for FREE CATALOG

***TWECO-LITE,** the new flexible ALUMINUM welding cable that weighs half as much, costs less and lasts longer.

a product of TWECO PRODUCTS CO. Wichita 1, Kansas

NEW PRODUCT BRIEFS

"Turco-Solv" solvent is designed for electrical cleaning. Solvent is said to be quickly soluble, evaporate quickly and contain no highly toxic ingredients. *Turco Products, Inc.*
Circle No. 24.

* * *

Tighter, quicker seize for cutting wire rope is advantage of "Punch-Lok" hose clamps, according to manufacturer. Clamps can also be used as permanent seize. *Punch-Lok Co.*
Circle No. 25.

* * *

Lead bearing steel plate, "New E-Z-Cut", is a free machining plate, said to have superior welding, polishing and plating properties. *Joseph T. Ryerson & Son, Inc.*
Circle No. 26.

* * *

"Vize-An-Ammer" is a diamond-shaped crimp designed to produce a connection with maximum conductivity. *American Pamcor Inc.*
Circle No. 27.

* * *

"Tip-Shaper" file of curved design, with non-clogging, self-cleaning curved teeth, can be used for deburring seam welding wheels and shaping electrodes. *Copperloy Corp.*
Circle No. 28.

* * *

Clamp for small precision work combines best features of C and parallel clamps, with side plates of high tensile steel and grooved jaws which rotate in one plane. *Saxton Mfg. Co.*
Circle No. 29.

For more information use card on page 97

A Correction

WELDING ENGINEER's Engineering Data Sheet No. 181 in the October issue listed electrode trade names and comparable AWS-ASTM designations. An error in the General Electric Co. column listed its W-612A through D electrodes under the E6011 designation.

Also transposed was G-E's W-613A, which appeared in the E6012 column. Further G-E electrodes inadvertently omitted are as follows:

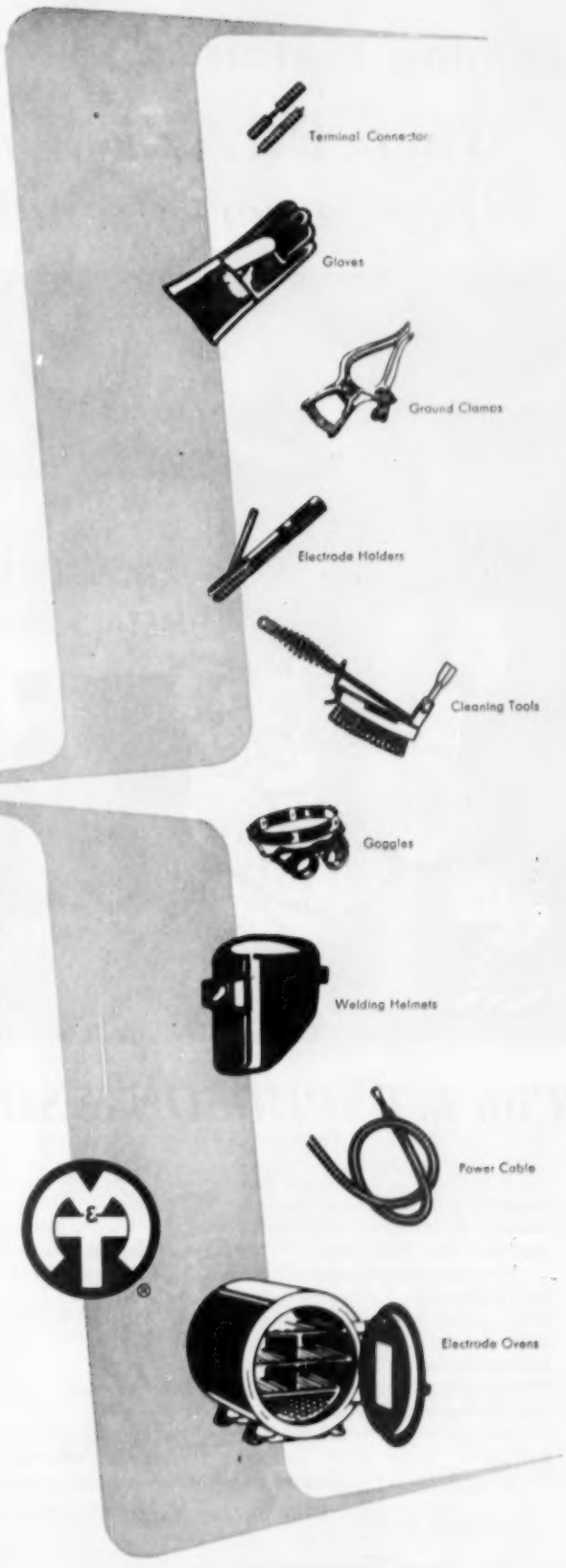
AWS-ASTM	G-E
E 4510	Types F and L
E 6010	W-610 B
E 6011	611 A
E 6016	616 A

FROM CONNECTORS TO OVENS . . . . . .

Metal & Thermit and its distributors carry a complete line of arc welding accessories. Selected for their quality, and stocked for your buying convenience, they are always on hand when you need them.

Buying your welding accessories, Murex Electrodes, and M & T Welding Machines from one dependable source assures you prompt delivery, personalized service, and purchasing economy. Buying M & T down the line is good safety insurance too, because every product has been field tested to serve you well.

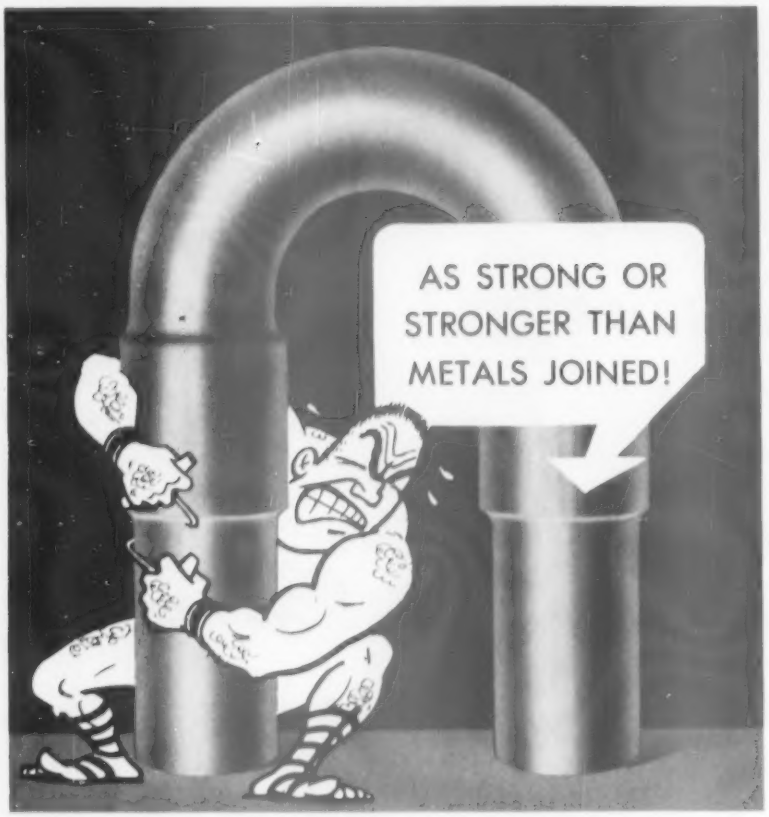
For a copy of the M & T accessories catalog contact your nearest M & T branch office, or write.



METAL & THERMIT CORPORATION • WELDING DEPARTMENT • 100 EAST 42ND STREET, NEW YORK 17, N.Y.

Joining Metals?

Then **BRAZE** *Them For Super-Strength!*



With L.T. PHOSON & SILBOND*

It's a fact! L. T.* brazed joints properly designed are as strong or stronger than the metals joined . . . and they stay that way!

Plus the strength factor, Phoson and SilBond L. T.* brazed (stress free) joints have high electrical and thermal conductivity, excellent resistance to corrosion . . . they eliminate finishing costs and give overall maximum economy.

Send us a part you have been joining by some other method. We'll test braze it for you and give you a per-part time and material analysis.

If you're joining metals, you'll decide, as so many others have, to L. T.* braze with Phoson and SilBond.

Ask for PHOSON – SIL BOND Booklet.

*Low Temperature

UNITED WIRE & SUPPLY CORPORATION
Brazing Alloy Division • Providence 7, R. I.
Offices in Principal Cities • Coast-to-Coast

Contact Your Welding Supply Distributor

UNITED *LOW TEMPERATURE* BRAZING ALLOYS

Permanently United

NEWS . . . . . *from page 6*

permitting gravity to eliminate the weld bead on the inside of the tubing. Even in the as-welded condition, the tube is claimed to have a smooth and flawless interior surface. Tig (tungsten inert-gas) welding is used in fabrication.

* * *

Acute copper-brass shortage threatens

A serious shortage threatens the copper and brass industry as a result of strikes and shutdowns this summer and the recent devastating floods in parts of New England. Inventories have been depleted "almost to the vanishing point" according to a survey of the country's warehouses and distributors made by the Copper & Brass Warehouse Association.

The floods have made perilous a situation already critical, coming so soon after the reduced summer production.

Far-reaching as the shortage is (affecting every major industry utilizing copper and brass) a recommendation made to the government stated normalcy could be restored by release of 100,000 tons of stock-piled Chilean copper. Release of the copper would also help eliminate dangers of inflation and profiteering, the association said.

* * *

Arizona distributor aids student welding contest

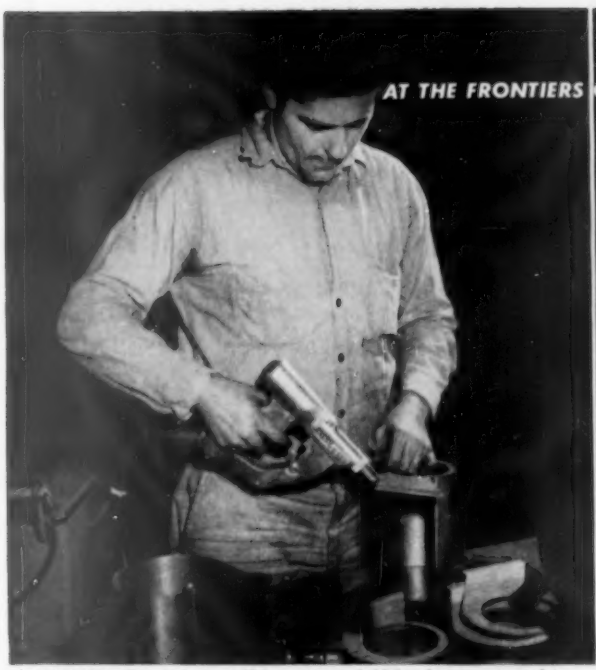
Agricultural students from the state of Arizona recently participated in the annual farm welding contest sponsored by Phoenix Welding Supply Co., Phoenix, Ariz. Over $500 worth of prizes were awarded. The contest was conducted in cooperation with the Arizona Association of Future Farmers of America.

The contest was open to all students in the state enrolled in vocational agricultural classes. The student had to build his welded project using less than 50% new material. First prize was won by Greg McCleery; second prize went to John Hightower; third prize went to Joe Anderson. Judges were J. A. Rau, chief engineer of Allison Steel Mfg. Co.; Charles Fogwell, Fogwell Machine Co.; Douglas Todd, member of the State Farm Bureau.

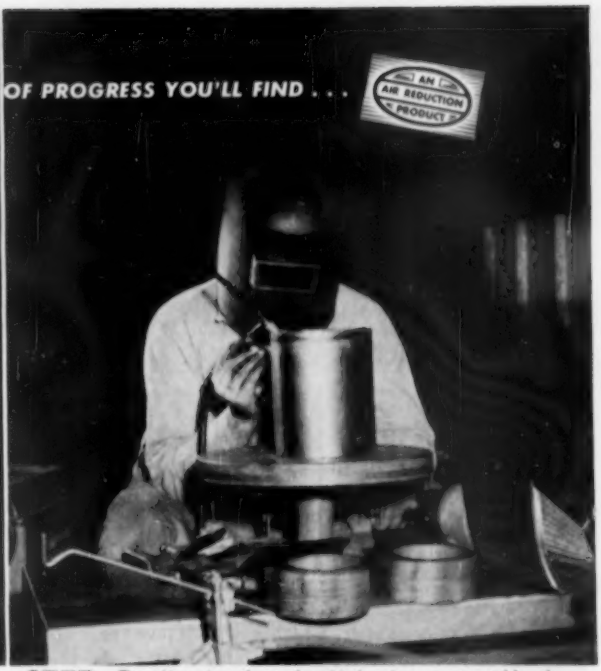
* * *

John Tillman & Co. increases plant

John Tillman & Co., Long Beach, Calif., is in the process of expansion. A new office and warehouse are being added.



STEP 1. Using an Aircospot gun, (which takes one second to make a strong, sound spot weld), the Falstrom operator tack-welds flange on a metal cover. An average of 10 tacks are needed. The metal is 16 gauge mild steel.



STEP 2. Mounting the tack-welded unit on a turntable, the same operator exchanges the Aircospot gun for an HB-S Heliweld holder. The Airco Heliweld process joins the circumferential seam at a speed of 16 inches per minute.

Falstrom Company
...eliminates jigs and back-up plates with AIRCOSPOT
...speeds seam-welding 75% with HELIWELDING!

It used to take 17 minutes to tack and weld a complete metal cover at the Falstrom Company, Passaic, N. J. Now, with a combination of Aircospot and Airco Heliwelding, this operation has been reduced to a fraction of the time.

Previous methods of tack-welding required the use of jigs and fixtures—a procedure that hampered the operator and slowed production. Aircospot, however, tack-welds from just one side of the metal. It eliminates jigs and back-up plates, completely streamlining the work flow. At the same time, by using Heliwelding instead of oxyacetylene welding, Falstrom was able to reduce welding time 75%. This faster method of welding thin sections of metal provided further economies as the end product required less finishing and grinding.

One, or both, of these Airco inert-gas shielded arc welding processes can provide similar savings in your particular operation. Contact your local Airco Sales Representative or Authorized Airco Dealer for an on-the-spot demonstration in your plant—or—write Airco direct for complete information. Request Aircospot Catalog #2315, Heliwelding Catalog #2300.

AIRCO

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company

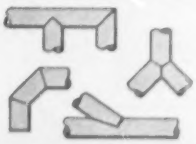
Represented internationally by
Airco Company International

Foreign Subsidiaries:
Air Reduction Canada Limited
Cuban Air Products Corporation

Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO—industrial gases, welding and cutting equipment, and acetylenic chemicals • PURECO—carbon dioxide, liquid-solid ("DRY-ICE") • OHIO—medical gases and hospital equipment • NATIONAL CARBIDE—pipeline acetylene and calcium carbide • COLTON—polyvinyl-acetates,—alcohols, and other synthetic resins.

LAY OUT ANY PIPE JOINT

LAY OUT ANY PIPE JOINT, SHOWN BELOW, on any size pipe from 1½" to 48"



Mark Structurals
Adapter for marking structural angles included with either model of the Contour Marker.

The proven, fast easy way

IN LESS THAN 5 MINUTES you can lay out a Y, a T, an L or any angle joint with a Contour Marker. IT'S EASY and absolutely accurate; it is calibrated in both degrees and pitch. Just set the angle and with a smooth swing of the Contour Marker's soapstone point you are ready to cut! You save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are eliminated.

Two Sizes: Standard, for pipes 1½" to 18" dia.; Jumbo, for pipes 16" to 48". Instruction book included. Belt case available. Write for information.

Sold by welding supply dealers everywhere.

CONTOUR MARKER CORP. OF CALIFORNIA
1843 East Compton Boulevard, Compton, California

BOYCE CENTERING HEAD marks *center line* at any degree of angle on pipe, shaft, tube. Leveling gauge on dial.

24" RADIUS MARKER is folding compass of Dural aluminum. Folds to 9¼" pocket size; weighs 8 oz.

PIPE FLANGE ALIGNER expands and centers inside pipe to align flange for welding. For any pipe dia. 3" to 12"

THE *Original* CONTOUR MARKER
ACCURACY PROVED BY TEN YEARS OF SERVICE TO WELDERS

IT WELDS LIKE A CHARM

Send for FREE CATALOG

*TWECO-LITE, the new flexible ALUMINUM welding cable that weighs half as much, lasts longer, and costs less

a product of TWECO PRODUCTS CO. Wichita 1, Kansas

Syracuse Special Machine moves into unique building

Syracuse Special Machine Co., Syracuse, N. Y., has moved into a new building heated and cooled by a unique method. The roof of the building is covered by 6 in. of water in the summer and 6 in. of ice in the winter.

In winter, the ice acts as an insulator, making the building easy to heat and keep at an even temperature. During the summer, the 6 in. of water overhead keeps the building at least 10 deg cooler than a conventional roof.

* * *

Eastern Welding opens new branch

Eastern Welding Equipment Co., Inc., New York City, has opened a new branch at 775 Old Country Rd., Westbury, L. I., N. Y. John Mergel has been named manager. The modern building has a large retail store and display room. There is 5,000 sq ft of storage space, exclusive of the store and display room.

* * *

Three share Lincoln machine tool award

The $3,000 first prize in the Machine Tool Design Award Program, sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, has been awarded to three engineers.

The award was made on the basis of a cooperative paper describing development work on vibration and rigidity. The project was undertaken in designing an internal grinding machine with welded steel construction.

The recipients were Dr. Max Kronenberg, consulting engineer, Cincinnati; Paul Maker and Edward Dix, senior research engineer and project-design engineer, respectively, Bryant Chucking Grinder Co., Springfield, Vt.

* * *

Welding Engineering in new Milwaukee plant

Welding Engineering Co. recently occupied its new plant at 136 N. 120th St., Milwaukee. The firm, founded in 1930 by A. H. Friese, plans added service due to this new facility.

Welders are Comfortable and Fully Protected in AO WELDING HELMETS!

AO 890-4C
Seamless
Welding Helmet

Permits welder to observe work without raising helmet. Helmet can be thrown back on head or brought to welding position easily.

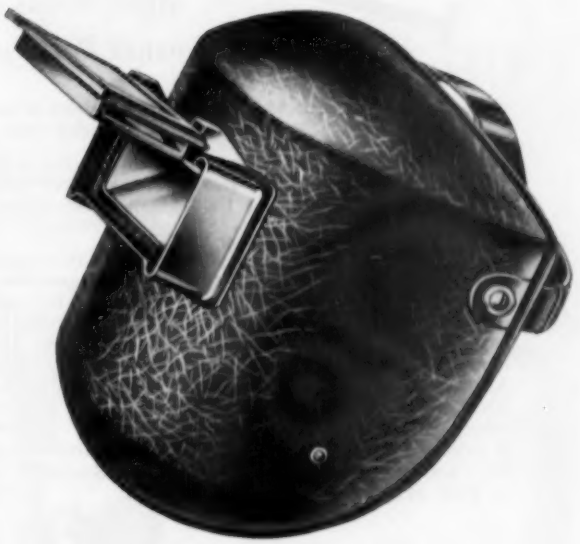
REPLACEMENT PARTS — No. 4 Free Floating Quick Adjustable Headgear. Type C Outside Adjustable Friction Joint. No. 1182 Fibre Chin Rest. No. 1096 Insulated Dowmetal Lift-Front Glass Holder. Helmet is one-piece vulcanized fibre, lightproof. Protects against arcs of nearby welders. Available with Noviweld or Filterweld plates which can be protected from pitting or scratching by easily replaceable clear or coated glass cover plates.

NOTE: All helmets furnished standard without glass. When glass is desired, specify type and shade. Clear or Calobar hardened 2″ x 4¼″ plate for inside of glass holder available at extra cost.

ALTERNATES: 894-4C with Dowmetal Inverted Glass Holder
896-4C with Plastic Inverted Glass Holder
898-4C with Plastic Lift Front Glass Holder

AO 666-9 WELDING HELMET

Very inexpensive — made from a flat fiber sheet. Extra strong rivets. Very lightweight for comfort. No projections make it ideal for close quarters work. Special type headgear, 2 positive Stop Joints — one holds helmet in position on face, other keeps in "off guard" position. Slide adjustment for comfortable fit. Genuine leather sweatband. No. 1165 Two Piece Metal Glass Holder for quick insertion or removal of welding plates. Accommodates Noviweld or Filterweld plates — these can be protected by easily replaceable clear or coated glass cover plates. Weight without glass 18 oz.



AO 704-3C WELDING HELMET
(Compression molded fiberglas shell)

Seamless. Shell is thermo-setting. Fiberglas reinforced by compression molding. Very strong, impervious to moisture, won't warp, lighter than vulcanized fiber. Its ruggedness, heat resistance and superior wear have paid off on the job. Easily cleaned or sterilized. Model illustrated has No. 1136 Plastic Lift-Front Glass Holder. No. 706-3C has No. 1096 Insulated Dowmetal Lift-Front Glass Holder. Our No. 3 moisture-proof plastic headgear will not absorb moisture thus eliminating warpage and insuring lasting comfort. Free floating type headgear. Wide range adjustment to fit any head. Entire adjustment mechanism completely insulated.

American Optical
SAFETY PRODUCTS DIVISION

Your Nearest AO Safety Products Representative Can Supply You

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

†T. M. REG. BY AMERICAN OPTICAL COMPANY

How Federal Helps Whirlpool

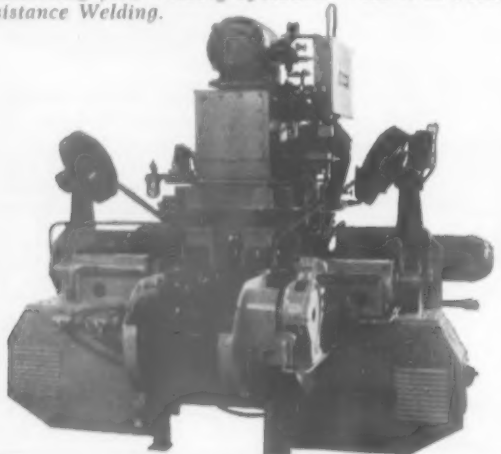
BUILD BETTER HOME LAUNDRIES

Mills, Welds, Tests
1,000 Washer Parts per Hour!

A special resistance welder designed by Federal is helping Whirlpool build better home laundries, faster at reduced costs.

It is believed to be the first machine to combine a milling operation with resistance welding. It also assembles three parts and performs a 100% test — completing 1000 finished assemblies per hour with one operator.

The assembly is a tub suspension rod, and is comprised of a length of rod, a bracket and two metal discs. The operator fits the bracket over the rod and drops it into a hopper — the machine does the rest. It carries the rod to a milling station where the rod ends are machined to proper radius for best projection welding. The two discs are hopper fed to the ends of the rod at the welding station. After welding the parts are automatically transferred to a test station where each assembly is given a 3000 pound "pull test." This is another example of how Federal's "know how" in resistance welding is paying dividends to one of America's leading manufacturers. Next time you're considering your welding operation — think of *Federal — First in Resistance Welding.*



Neat, compact Federal resistance welder that speeds production of tub suspension rods for Whirlpool.

Federal WELDERS®
Warco PRESSES®

The Federal Machine and Welder Company
WARREN, OHIO

Norelco holds X-ray school in San Francisco

More than 100 scientists attended the 21st X-ray diffraction school recently held in San Francisco under the sponsorship of the Research & Control Instruments Division, North American Philips Co., Inc., Mt. Vernon, N. Y.

* * *

National Lead forms new Australian firm

As a part of its Australian expansion, National Lead Co., New York City, recently formed a new subsidiary, Mineral Deposits Pty. Ltd. The firm, which has acquired the plant and mine of Mineral Deposits Syndicate of Australia, will operate under ownership control by National Lead and its former Australian owners.

Mineral Deposits owns a plant and mine in Southport, New South Wales. It also has mineral leases in Queensland and New South Wales. The subsidiary will devote its activities to mining, concentrating and exporting ilmenite and rutile. These materials are used for production of titanium metal, titanium oxide pigments and welding rod coatings. Zircon and monazite will also be processed.

The above minerals have been produced and marketed, up to the present, through Titanium Alloy Mfg. Co., Pty. Ltd., Cudgen, New South Wales.

* * *

Cross-country freighter

—Courtesy R. G. LeTourneau, Inc.

THIS cross-country freighter easily navigates city streets. Specially designed for use in isolated areas, the freighter's low-pressure tires provide flotation over all types of terrain, including snow and sand. Built-in electric motors give individual driving power to each wheel, and a special steering arrangement allows each trailer to follow exactly in the tracks of the lead car. (The welded fabrication of a "Sno-Freighter" for Arctic use was featured on p. 31 of the July issue of WELDING ENGINEER.)

GLENN COMPANY
CONSTANT VOLTAGE
News Notes

CV Welding Speeds Water Heater Production

Four major U.S. water heater manufacturers now use GLENN CV automatic welders. Why? Because GLENN CV makes automatic welding *truly* automatic. Arc voltage stays constant – no voltage or feed control problems. Current can be increased for faster welding with fewer rejects. The result is far higher production at much lower cost.

GLENN CV welders are job-proved for submerged arc, inert gas, CO-2, "squirt" and automatic hard facing and stud welding processes. 3 models – 500, 750 and 1200 amp. continuous duty rating, 18-42 v. arc voltage range. Operate from 3-phase a.c., deliver d.c. welding current at 85%-plus efficiency, 90% or better power factor. Write or wire for literature, application data, prices. 4

GLENN COMPANY
CONSTANT VOLTAGE PIONEERS
3134 E. 10TH STREET
OAKLAND 1, CALIF.
10228 SO. AVE. N.
CHICAGO 17, ILL.

Wall Colmonoy develops new titanium brazing

A new method of furnace-brazing titanium and titanium alloys has been developed by Wall Colmonoy Corp., Detroit. It has been almost impossible to satisfactorily braze titanium to other metals. The Wall Colmonoy method employs a specialized vacuum technique; no flux is required.

By using silver and silver-manganese alloys, titanium, furnace-brazed by this process, is not embrittled, nor does it lose its ductility. Good joint physical properties (20,000 to 25,000 psi shear) result. The titanium can then be used for complex assemblies.

* * *

Stulz-Sickles holds welding symposium

A three-day symposium on reclamation welding was held recently by Stulz-Sickles, Newark, N. J., at the Skytop Club, Skytop, Pa. The firm's sales and administrative personnel attended.

The meeting was presided over by Burt H. Payne, chairman of the board of Stulz-Sickles. Roderick K. Chapin, president and general manager, outlined the company's plans for an accelerated products development program for 1956.

*TWECO-LITE

*the new flexible ALUMINUM welding cable that weighs half as much, lasts longer, costs less

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A Product of
TWECO PRODUCTS COMPANY
Wichita 1, Kansas

Tempilstik° FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon... marks like a crayon... tells temperatures like a precision instrument!

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures–plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM...WRITE "WELDING SALES" DEPT. FOR SAMPLE TEMPIL° PELLETS...STATE TEMPERATURES OF INTEREST—PLEASE!

Tempil° CORPORATION
132 WEST 22ND STREET, NEW YORK 11, N. Y.

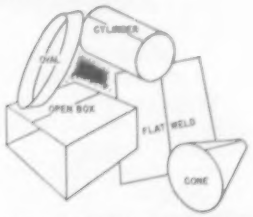
Available in these Temperatures (F.)

113	375	1000
125	388	1050
138	400	1100
150	413	1150
163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
363		2000

AIRLINE'S "KNOW-HOW" AT YOUR DISPOSAL
These two fixtures can give you
Accurate — Smooth — Pressure Tight
FUSION BUTT WELDS

If you make these

You need these



AIRLINE MODEL LW SERIES 1000
Longitudinal Welding Fixture
Manufactured in 2 ft. to 12 ft. lengths. "Toe touch" control permits controlling fingers from any position. Welds sheets, cones, cylinders, boxes, etc., from .010 to one inch thickness. Suitable for MIG, TIG, submerged-arc and hand welds. Available also as complete package.

AIRLINE MODEL R 4000
Planishing Roll—60 Inch Throat
High Roller Face Pressure. Cold works welds and adjacent areas, flattens & smooths fusion welds, increases mechanical properties, reduces grinding. Also flattens flash welds, mash welds, resistance welds and elongated weld areas. Diameters 1¾ in. to 10 ft., and to 10 ft. lengths on large diameters.

WRITE TODAY FOR COMPLETE DATA AND SAMPLES

AIRLINE WELDING and ENGINEERING
785 N. Prairie, Hawthorne, Calif., ORegon 8-5112 - OSborne 5-2225

LOOKING
for a MORE economical way to rebuild worn tractor grousers?

Try
SS HI-C TRACTOR GROUSER BARS
HIGH CARBON STEEL ALLOY

- Give long wear under severe conditions at a very low cost.
- Use any good grade of low hydrogen electrode to attach.
- Also easy to attach by almost any automatic welding method.

Write for Details and Price List

ORDER THROUGH YOUR NEAREST MANGANAL DEALER

STULZ-SICKLES CO.
SOLE PRODUCERS 92 N. J. RAILROAD AVE. NEWARK, N. J.

NEAREST DISTRIBUTOR UPON REQUEST

Wayne Welding Supply builds addition

Completion of the new addition to its plant, will give Wayne Welding Supply Co., Inc., Fort Wayne, Ind., a display area of 1,140 sq ft. The counter and counter display will be 80 ft long.

The new offices will be on the second floor of the addition. A basement area of 2,145 sq ft is planned for welding clinics and demonstrations.

* * *

Electro Refractories buys interest in Spar-Mica

Electro Refractories & Abrasives Corp., Buffalo, N. Y., has purchased interest in Spar-Mica Corp., Montreal, Canada. Included in the arrangement is development of two large deposits of feldspar and mica located on tide water in the St. Lawrence river and Gulf of St. Lawrence areas.

Electro will also manage Spar-Mica and Golding-Keene Co., Keene, N. H., a Spar-Mica subsidiary. Three Electro directors, Carl F. Leitten, executive vice-president; Eugene D. Cowlin and Oliver A. Weppner, have been elected directors of both Spar-Mica and Golding-Keene.

* * *

Nelson Stud executives attend conference

Executives of the Nelson Stud Welding Division, Gregory Industries, Inc., Lorain, Ohio, recently attended the first international conference on welding. The sessions were held in England under the sponsorship of Crompton-Parkinson, Ltd., British manufacturers of stud welding equipment and fasteners.

The conference was held to aid exchange of stud welding research and product development programs currently underway in 12 overseas countries.

Representatives for Nelson Stud were George E. Gregory, president of Gregory Industries, Inc.; Maurice A. Enright, vice-president engineering, and Robert C. Singleton, industrial sales manager.

* * *

Mallory-Sharon certifies titanium

"Quality certification" has been introduced by Mallory-Sharon Titanium Corp., Niles, Ohio. Using statistical quality-control techniques to improve uniformity of unalloyed titanium sheets, the company now certifies mechanical properties within narrow ranges.

No accidents in compressed gas transportation

According to the Bureau of Explosives "Report of the director and chief inspector of the Bureau for the safe transportation of explosives and other dangerous articles," there were no reported accidents involving acetylene or oxygen during transportation by rail freight and rail express during last year.

The report covered inspection reports covering the manufacture of 2,486,968 refillable compressed gas cylinders and numerous non-refillable compressed gas cylinders. Similar reports for 659 cargo tanks and 614 portable tanks for the moving of compressed gases were also examined.

* * *

Babcock & Wilcox plans Virginia atomic plant

Babcock & Wilcox Co., New York City, has applied to the Atomic Energy Commission for license to construct and operate a fuel element fabrication facility near Lynchburg, Va. Its estimated cost will be $2,000,000.

* * *

Inco technical section in Philadelphia area

Headquarters of the Central Atlantic Coast technical field section of International Nickel Co.'s development and research division have been relocated in the Philadelphia area. The new address of the section is the Abington Bldg., 1150 York Rd., Abington, Pa. The section was formerly in New York City.

* * *

Pako Corp. initiates X-ray reporter

Pako Corp., Minneapolis, has begun publication of the *X-Ray Pakodoper*, a paper devoted to news and ideas about industrial X-ray. Included will be the latest about techniques, new installations and equipment.

* * *

Orders up 30% for 8 months say RWMA

Business for the first 8 months of 1955 is 30% above orders for the same period of last year, according to the Resistance Welder Manufacturers' Association. Shipments for the same period are 14% above that for last year.

* * *

Welcast Plastics at new plant

Welcast Plastics Co. has moved to its new plant at 50 E. Springfield Rd., Barberton, Ohio. Its mailing address, however, is still 721 E. Baird Ave.

Alloy Rings

cut Brazing Rejects to less than 1% in Refrigerator Compressor Dome Assembly

* Actual photo of refrigerator plant production line where 11 joints are brazed on one assembly with less than 1% rejected under Underwriter's pressure test of 1500 lbs. per sq. in.

Alloy brazing materials insure a perfect job every time . . . consistently uniform, trouble-free brazing with no rejects . . . no reworking!

No question about it—Production Brazing with Alloy Rings is the practical answer to many expensive metal joining problems. Investigate . . . production brazing can help you conquer those sky-high production costs.

Precision is of the utmost importance in successful brazing. For infallible results insist on precision-made Alloy Rings. Special Alloy packaging methods speed production and cut waste to a minimum.

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. . . Automatic - for brazing
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Created primarily for brazing of carbon and low alloy steels, brass and copper base alloys, and monel. Going great guns in silver-brazing.
Simple • Rugged • Compact
Flux always clean

Ask your A-S Distributor to demonstrate "Jet Flux" . . . show 10% time saving

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

COMING EVENTS

NOV. 3-4: Western Zone Meeting, NWSA, Ambassador Hotel, Los Angeles.

NOV. 28-30: Annual Fall Meeting, Independent Oxygen Manufacturers Association, Edgewater Beach Hotel, Chicago.

DEC. 5-6: Southeastern Zone Meeting, NWSA, The Dinkler Plaza, Atlanta, Ga.

DEC. 8-9: Southwestern Zone Meeting, NWSA, Shamrock Hotel, Houston.

JAN. 1: Fortieth Anniversary of WELDING ENGINEER.

FEBRUARY (Dates to be announced): Welding Conference, University of Wisconsin, Madison.

FEB. 1-2: Second Annual Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

MARCH 12-14: Fifty-sixth Annual Convention, International Acetylene Association, Hotel Statler, Los Angeles.

MARCH 19-22: Twelfth Annual Convention, National Welding Supply Association, Hotel Roosevelt, New Orleans.

MAY 8-11: Thirty-seventh Annual Meeting, American Welding Society, Hotel Statler, Buffalo.

MAY 9-11: Fourth Annual Welding Show, Memorial Auditorium, Buffalo.

Empire Welding has new name

Empire Welding Co., Norfolk, Va., has changed its name. It is now operating as J. J. Pipes Welding Service, located at 3008 Cromwell Rd., Norfolk, Va.

* * *

Welding Sales plans warehouse addition

Welding Sales & Engineering Co., Detroit, has begun construction of an additional 4,000 sq ft of warehouse space.

* * *

Distributor appointments

Ampco Metal, Inc., Milwaukee: Buffalo Welding Supply Co., Buffalo, N. Y.; Randall-Graw Co., La Crosse, Wis.; Hays Supply Co., Memphis, Tenn.

Carboloy Department, General Electric Co., Detroit: Baldwin Supply Co., Charleston, W. Va.

Climax Molybdenum Co., New York City: Whitehead Metal Products Co., New York City.

Federal Tool Engineering Co., Cedar Grove, N. J.: Sullivan-Cassimus Co., Los Angeles & San Francisco.

Unique Turntable & Equipment Corp., Brooklyn: Charles S. Freeman Co., Buffalo, N. Y.

Brazing

BRAZING MANUAL. By Committee on Brazing & Soldering of the American Welding Society. Published by Reinhold Publishing Corp., New York City, 1955. Cloth, 6 by 9 in., 193 pages. Price $4.75.

This manual presents, for the first time, a compilation in one handy volume of up-to-the-minute brazing processes now in use. Compiled by leading authorities, this reference book describes, in separate chapters, equipment and methods involved in the eight brazing processes discussed. Special attention is given to joint design, properties of brazing similar metals, fluxes and atmospheres, and the cause of defects, together with corrective measures.

An appendix lists, in convenient chart form, properties of brazeable metals and alloys such as aluminum, copper, brass, bronze, silver, nickel, gold, etc.

* * *

Engineer's handbook

HANDBOOK OF ENGINEER MATERIALS. Edited by Douglass F. Minor and John B. Seastone. Published by John Wiley Sons, Inc., New York City, 1955. Flexible fabricoid, 5½ by 8½ in., 1,400 pages. Price $17.50.

In compiling this volume, the editors have aimed at developing a single source of information on the usual materials of manufacturing and construction. The book is divided into four sections: general information on materials, metals, non-metals, and construction material.

The handbook is not intended for the general public as it assumes a basic technical knowledge and vocabulary covering units of measurements, methods of calculation and type of geographical presentation, at a high academic level. The book will be, however, of value to engineering designers of products and construction projects, research workers and advanced students.

One of the features that will make this handbook valuable is the elimination of historical background and methods of manufacture not of prime interest to users of construction materials. Included are references covering all branches of engineering, with more than 1,000 tables.

FIRST TRULY PORTABLE
200 AMP. ARC WELDER
Weighs only 65 lbs.; carry it to the job!
Using the first TOROIDAL transformer!

BREN-WELD
TRADE MARK
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OBSOLETES ALL OTHER
WELDERS OF COMPARABLE RATING!

Employing the first toroidal transformer ever used in arc welders, the portable Bren-Weld does the work of conventional welders 4 to 5 times its size and weight. Eliminates the necessity to transport bulky equipment or heavy parts to be welded. *Now you can carry Bren-Weld to the job!*

Bren-Weld handles electrodes from 3/64" through 5/32"; it has adjustable arc voltage for various arc characteristics.

Because it is so flexible in operation and application, Bren-Weld is ideal for plant production and maintenance, for construction work, for railroads, on the farm and in home workshop.

24 HOUR DELIVERY FROM STOCK!

- 200 Amp.—At 50% Duty Cycle
- 250 Amp.—Reduced Duty Cycle
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- *Also Available For 220/440 Volts*
- Simple To Use—Fully Guaranteed

11" x 12" x 7½"
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Lowest Price On Market For Comparable Ampere Rating

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SPAT-R-PRUF
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Don't sputter about spatter . . .
JUST WIPE IT OFF!

Completely eliminates grinding after welding. Just one coat, and spatter can be wiped away with a dry cloth.

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SPECIAL FLUX
FOR GENERAL BRAZING
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AT THE FRONTIERS OF PROGRESS YOU'LL FIND

FOR WELDING AND CUTTING...

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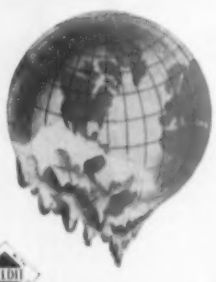
Weldit

THE WORLD'S FINEST SALAMANDER USED the WORLD OVER!



Weldit, Inc. proudly introduces their new L-P "Heaterama" Salamander, Model #900. Designed to give maximum high heat output at low cost, it features the famous "Flame Dome" for 360 degree heat distribution and 100% automatic safety shut-off. Floor type Model #800 and Tank Top Model #1850 also available.

Weldit INC. SINCE 1918

990 OAKMAN BLVD.
DETROIT 38, MICHIGAN

Charles R. Holton, Jr., has been named to the board of directors of American Welding & Mfg. Co., Warren, Ohio. The firm also made the following changes: *Williard R. Richards* has been named production control supervisor. *R. E. Goodman* has been appointed quality supervisor. He was formerly chief inspector. *Forrest W. Johnson* has been named plant metallurgist. *Raymond F. Zeller* has been promoted from assistant chief inspector to chief inspector.

* * *

V. V. Netch has been named manager of welder sales for Vickers Electric Div., Vickers, Inc., a unit of Sperry Rand Corp., St. Louis. Mr. Netch was formerly vice-president of Hill Equipment Engineering Co. and has specialized in the welding field for the past 22 years. *C. M. (Mike) Burnett* will continue as coordinator of dealer representatives.

Netch

* * *

A. J. Fausek has been named chairman of the board of Modern Engineering Co., St. Louis, Mo. Mr. Fausek was formerly president of the firm. The International Acetylene Association awarded him the James Turner Morehead Medal in 1952 for his contributions to the design and development of oxy-acetylene equipment and the promotion of safety standards. *I. F. Fausek* is now president of the firm.

* * *

Warren L. Hardy was named business research manager recently by Norton Co., Worcester, Mass. He succeeds *Myron N. Smith*, who has retired.

* * *

Henry X. Kelley has been appointed sales manager of Silver Welding Supply, Inc., Roslindale, Mass. *F. Charles Palmer* has been made assistant treasurer. *Richard G. Gould* and *Richard Nolan* have joined the firm's sales staff.

Raymond J. Wean was recently elected a director of The Federal Machine & Welder Co., Warren, Ohio.

* * *

W. D. Kleppinger has been elected vice-president of the chemical equipment division, General Ceramics Corp., Keasbey, N. J. He formerly was general manager.

* * *

Sheldon V. Clarke has been appointed manager of the general purchasing department, Union Carbide & Carbon Corp., New York City. He succeeds *H. V. Huffard,* who is retiring after 40 years of service.

* * *

Roy B. McCauley, Jr. was recently appointed chairman of the department of welding engineering, Ohio State University Columbus. Mr. McCauley, an associate professor of welding engineering, is a member of the American Welding Society. He is currently vice-chairman of the Columbus section.

* * *

E. F. Hannum has joined Welding Sales & Engineering Co., Detroit, as manager of its new sales department: steel alloys for maintenance.

* * *

William C. Powell has been named district sales manager for the tubular and process equipment division of A. O. Smith Corp., Milwaukee. *Joseph Coffman* has joined the sales force of the process equipment division.

* * *

Frank R. Fudesco has joined Cottet's Welding Supply Co., Syracuse, N. Y., as general partner.

* * *

John B. Davies, manager of industrial sales, Mine Safety Appliances Co., Pittsburgh, was elected president of the Industrial Safety Equipment Association at a recent meeting.

* * *

Ernest Nuber has been promoted to general field sales manager for The Bristol Co., Waterbury, Conn. Mr. Nuber joined the Bristol sales engineering organization in 1929.

* * *

Ivan Bridges has been named assistant manager, purchasing and inventory control, of R & R Welding Supply Co., Des Moines.

Tensile Testing

Fast!
Accurate!
Easy!

This compact machine tests spotwelds, strip, wire, anything within its 20,000 lb. capacity. Hydraulically powered, it has an easily controlled ram, self-acting specimen grips that are open sided for easy specimen insertion. This tester, Model ST-1, is adjustable to take specimens 5" to 9" in length. Various load gauges, grips, and other modifications are available.

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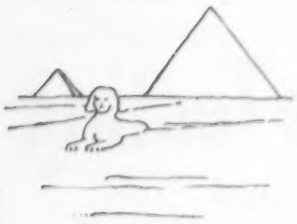

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Industry expects 25 to 30 years or more of useful life from high pressure gas cylinders. This expectation is based on long experience with cylinders made by Harrisburg Steel Corporation and its subsidiary, Taylor-Wharton Iron and Steel Company.

Don't let your desire for lightness cause you to use cylinders with walls so thin that they pass I.C.C. inspection without an adequate reserve. Will such cylinders last 25 years? No one knows.

Extreme uniformity of wall thickness in our cylinders makes it certain that they carry no excess weight. They are, therefore, as light as is consistent with *sound design and safety.*

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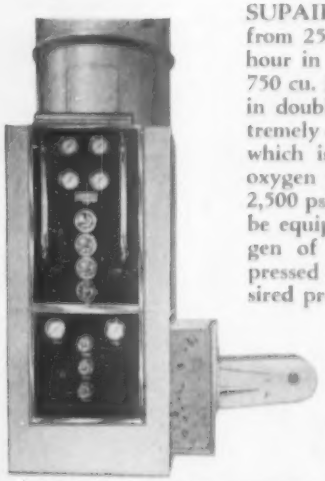

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These plants are simple to install, easy to operate, and require minimum maintenance. SUPAIRCO plants are known all over the world for efficiency and reliability. For full details send for catalog.

Double rectification column with liquid pump.

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Manufacturers of production and storage equipment for gaseous or liquid oxygen, nitrogen, air, hydrogen and helium

Theron S. (Ted) Bushnell has been appointed Midwest district manager of Tube Turns Plastics, Inc., Louisville, Ky. He will headquarter in Chicago.

* * *

S. B. Owings has been named assistant sales manager of Miller Electric Mfg. Co., Inc., Appleton, Wis. Mr. Owings was formerly associated with National Cylinder Gas Co., Chicago. He has been active in the electric arc welding industry for some time.

* * *

Paul V. Croteau was recently appointed district sales manager of the Eastern Division for Smith Welding Equipment Corp., Minneapolis.

* * *

Curtis Fife has joined Dye Oxygen Co., Inc., Phoenix, Ariz., as a salesman.

* * *

Died . . .

Bernadine (Bernie) Caluwaert, wife of E. C. Caluwaert, president of the National Welding Supply Association, died Sept. 25 after a long illness. She and her husband were co-founders and partners in O. K. I. Welding Supply Co., Cincinnati. Burial was from John J. Gilligan Funeral Home in that city. Mrs. Caluwaert is survived by her husband and two children, Bernadine and Michael.

* * *

Fred M. Wyman, assistant sales manager for National Cylinder Gas Co., Chicago, died recently. He was 65.

* * *

Two officials of Sylvania Electric Products, Inc., New York City, and their wives were killed in the recent United Air Lines crash near Laramie, Wyo. They were *John B. Merrill*, vice-president, operations, in charge of four divisions of the company, and Mrs. Merrill, the former Ann Tompkins of Towanda, Pa.; *James E. McGarr*, general manager of the Tungsten and Chemical Division, and Mrs. McGarr, the former Margaret Horgan of Danvers, Mass. Mr. Merrill's headquarters were in New York City and Towanda, Pa. He was 45. Mr. McGarr's headquarters were in Towanda. He, too, was 45. The Merrills are survived by two children; the McGarrs by four children.

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- Enables the weldor or blacksmith to produce a finer cutting tool with technical equipment.
- Produces a .01 to .02 in. case depth with necessary Brinell toughness on large and small low-carbon steel tools and parts.
- Write for sample and descriptive booklet.
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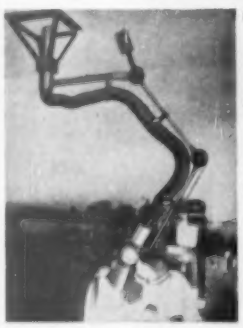

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- Portable and stationary units for all applications.
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Available in 9, 12, or 16 feet reach units.

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Engwald Corporation
357 LAFAYETTE AVE.
BROOKLYN, N. Y.

30 YEARS AGO

(Taken from *The Welding Engineer* of November, 1925)

Ralph R. Browning has been elected president of the Oxweld-Acetylene Co. and the Union Carbide Sales Co., New York City.

— 30 YEARS AGO —

A. J. Russell, Bettendorf Oxygen-Hydrogen Co., Bettendorf, Ia.; Walter Brant, Indiana Oxygen Co., Indianapolis, Ind.; Stanley Winger, Gas Products Co., Columbus, Ohio, and O. E Engler, The Balbach Co., Omaha, were recent visitors in Chicago.

— 30 YEARS AGO —

D. E. Cunningham has been appointed purchasing agent of Welding Service & Sales Co., Flint, Mich.

— 30 YEARS AGO —

F. C. Heppel, formerly sales manager of the Tulsa Oxy-Hydro Co., Tulsa, Okla., has joined the Bain-Beaird Co., Shreveport, La.

— 30 YEARS AGO —

George D. Purdon, district manager of Commercial Acetylene Supply, Chicago, was recently appointed a member of the committee on public safety and motor traffic of the City Club of Chicago.

— 30 YEARS AGO —

The John A. Roebling's Sons Co., Trenton, N. J., plans to erect a two-story plant in San Francisco in the near future.

— 30 YEARS AGO —

Organization of the new Los Angeles chapter of the American Welding Society was recently completed. L. G. Hicks was elected chairman, F. S. Hatfield, vice-chairman, and L. R. Ardouin, secretary and treasurer.

— 30 YEARS AGO —

Chicago Steel & Wire Co., Chicago has opened a branch office in Cleveland. R. R. Applegate has been named manager.

— 30 YEARS AGO —

A new oxygen plant is being built at Roanoke, Va., by Linde Air Products Co.

— 30 YEARS AGO —

W. R. Boyd, formerly of Burke Electric Co., Erie, Pa., has established a welding shop in that city.

— 30 YEARS AGO —

George J. Mohr has organized Mohr Welders Supply Co., Pittsburgh. He was formerly Purox manager for Pittsburgh.

"Red Head"

WELDING CLAMPS

- Designed for Welding
- No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.
2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.
3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

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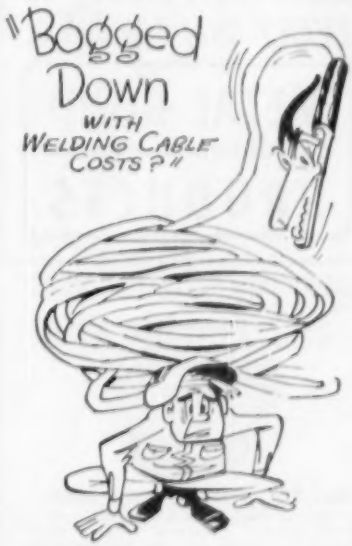

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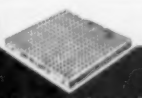

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51. X-RAY ANALYSIS—Holger Andreasen, Inc. Folder describes X-ray units for industrial radiography; with illustrations.

52. BRAZING—Lucas Milhaupt Engineering Co. 12-page booklet "Silver Alloy Preforms" treats silver brazing with preforms, with hints for selection of alloys and fluxes.

53. WELDING STATISTICS—Welding Engineer Publications, Inc. Folder graphically presents business expenditures in various types of welding. Figures for gas, electrode and steel production for the United States are also given.

54. MASONRY BLADES—The Carborundum Co. 4-page bulletin (A-1308 6-55) describes new "Niagara" line of masonry blades, giving types, sizes, applications.

55. ALUMINUM—All-State Welding Alloys Co., Inc. Folder discusses use of alloys and fluxes for soldering, brazing and welding aluminum.

56. INDUCTION HEATING—Lindberg Engineering Co. Bulletin 1480 describes and illustrates high-frequency units for heating and melting.

57. WELDERS—Morton Mfg. Co. Bulletin 44 gives models of automatic stake welding machines, with illustrations and specifications.

58. NOTCHER—J. F. Kidder Mfg. Co. Circular illustrates and describes "Little Blacksmith" No. 55 metalworking machine.

59. WELDING DATA—Haynes Stellite Co. *Haynes Alloys Digest* (Vol. 6 No. 10) contains an article on welding four high-alloy materials.

60. HEAT MEASUREMENT—Tempil Corp. "How temperatures are measured" is booklet discussing heat and temperature and means of measurement.

61. RESISTANCE WELDING—The Taylor-Winfield Corp. No. 556 of *Weld-It* discusses actual cases of resistance welding with solutions of operation problems.

62. POWER TOOLS—Master Pneumatic Tool Co., Inc. Catalog lists, with illustrations and specifications, types of pneumatic tools, including grinders, drills, sanders, chipping hammers.

63. SCALE CONTROL—Aqua Electric Scale Control, Inc. 4-page bulletin (200 R) describes five sizes of electric scale control units for prevention of hard scale in equipment cooled by or using water.

64. GRINDING WHEEL—Bay State Abrasive Products Co. *Grinding Wheel Reporter* (Vol. 1 No. 1) contains article on increasing grinding production.

65. WELDING CABLE—Uniflex Div. 20-page catalog lists resistance welding cable, water-cooled jumpers, connectors, etc.

66. BLAST CLEANING—Wheelabrator Corp. Bulletin PE-6 treats automatic cleaning of rust, flux and spatter from welded pieces.

67. STANDARDS—American Standards Ass'n. 48-page booklet lists and indexes 1,500 American standards, including mechanical, electrical and gas-burning appliances and welding.

68. GRINDER—New Era Engineering Co. Illustrated brochure describes the "Neeco-2-Twenty" abrasive-coated cloth disc grinder.

69. WELDING—Air Reduction Sales Co. "Spot welding from one side—with a portable gun" is a 12-page article reprint, with graphs and tables.

70. CABLE REEL—United Specialty Corp. Catalog sheet gives specifications for electric arc-welding cable reel.

71. INSPECTION—Multi-Amp Corp. Bulletin summarizes importance of maintenance and describes new testing equipment.

72. ELECTRODE—Arcos Corp. Pocket-size folder describes use of low-hydrogen electrodes in the welding of armor plate.

73. BRAZING—Handy & Harman. Bulletin 11-A discusses brazing carbide tool tips with "Easy-Flo No. 3" alloy.

74. BLAST CLEANING—Vacu-Blast Co., Inc. Folder contains description of models of the "vacu-blaster."

75. TITANIUM—Mallory-Sharon Titanium Corp. Bulletin presents new data on titanium with current specifications of titanium alloys.

76. ABRASIVES—Norton Co. Pocket-size folder details products of firm, including abrasives.

77. COPPER—Whitehead Metal Products Co., Inc. Reference manual contains up-to-date copper and copper alloy specification references.

78. CLEANING COMPOUND—Oakite Products, Inc. Literature describes new barrel deburring compound, also for use in descaling and derusting.

79. WELDING DATA—Tube Turns. "Piping Engineering" gives data on piping expansion and flexibility, with section on welded joints.

80. ELECTRODE—Mir-O-Col Alloy Co., Inc. Descriptive sheet treats "Mir-O-Col No. 3" hardfacing welding rod for electric arc use only.

81. SPOT X-RAY—Ind-X Corp. Lightweight, portable X-ray unit is subject of detailed sheet. Illustrations included.

82. TIP CLEANER—Universal Cutting & Welding Equipment Mfg. Co. Sheet discusses welding and cutting torch tip cleaners of stainless steel.

83. PYROMETER—Electronics Corp. of America. Bulletin PT 556 is a 4-page illustrated pamphlet giving data on pyrometer for high temperatures.

84. WELDING RELAYS—Automatic Switch Co. Bulletin 584 describes coilless type relays, designed to function like current transformers, for use in continuous welding.

85. FITTINGS—Babcock & Wilcox Co. Bulletin FB-500, first in series of folders, discusses seamless welding fittings available in alloy, carbon, stainless steels.

86. WELDER—Thomas Electric Welder Co. Bulletin 318 concerns flash and butt welders, with capacity tables, for production welding.

87. STEEL—U. S. Steel Corp. "Design Manual for High Strength Steels" (ADVL-215-54) is a handbook of technical information for users of high-strength low-alloy steels. It contains numerous charts and formulas. Data on structural carbon steel is also included.

88. WELDING SAFETY—Metropolitan Life Insurance Co. "Health protection in welding" is a 20-page pamphlet treating precautions for safe conditions for weldors. Single copies only available upon request.

89. HYDRAULIC PUMPS, CONTROLS—Vickers, Inc. Illustrated 56-page catalog (No. 5001A) describes line of oil-hydraulic pumps, controls and accessories, with recommended uses.

90. MOLYBDENUM—Climax Molybdenum Co. 72-page booklet is a compilation of technical, fabricating data on arc-cast molybdenum, including an application section.

91. WELDING DATA—Pandjiris Weldment Co. Leaflet presents graphs and tabulations designed to help in using semi- and fully automatic welding equipment on cylindrical vessels.

92. POSITIONERS—Worthington Corp. Bulletin No. R-1700-B15 gives seven basic points to consider in selecting positioners, with data on maintenance, table rotation and tilt range, and selection of speed drives.

93. WELDING CONTROL—Robotron Corp. Bulletin 356 illustrates and describes timer-ignitron combinations for control of automatic welding.

94. PRESS WELDER—Kirkhof Mfg. Corp. 8-page folder discusses spot and projection welders designed for high production.

95. WELDING WIRE—Reid-Avery Co., Inc. 4-page folder discusses wire for submerged arc welding with typical chemical composition ranges.

96. FUME EXHAUSTER—Torit Mfg. Co. Folder treats the portable fume exhauster for removing fumes and smoke from welding operations. Specifications are given and accessories listed.

97. STAINLESS STEEL—Wall Colmonoy Corp. 4-page folder, "Brazing & Processing Stainless Steel," describes "Nicrobraz" alloy and its use in brazing.

98. CLAMPS—Grand Specialties Co. Folder lists types of weldor's clamps. Illustrations and descriptions are included, and also recommended uses.

99. REGULATORS—Oxo Welding Equipment Co. Catalog 55 discusses available models of gas regulators, with specifications and performance data.

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102. Air Reduction Sales Co.—Catalog 2315 on "Aircospot" welding.

103. Air Reduction Sales Co.—Catalog "2300" on Tig (tungsten inert gas) welding.

104. Alloy Ring Service, Inc.—Information on brazing rings, preformed shapes, silver alloy, copper, soft solder and flux.

105. Alloy Rods Co.—Data sheet on hydrogen, iron-powder electrode.

106. All-State Welding Alloys Co., Inc.—Complete data on alloys and fluxes for welding, brazing, etc.

107. Aluminum Co. of America—Text on every phase of aluminum welding.

108. American Brass Co.—Write for Publication B-13 on uniform brazing.

109. Anti-Borax Compound Co., Inc.—Sample and booklet on case-hardening compound.

110. Bridgeport Brass Co.—New booklet, "Bronze Welding Alloys."

111. Burdett Oxygen Co.—Catalog on welding.

112. Carborundum Co.—Information on abrasives and grinding wheels.

113. Columbia Electric Mfg. Co.—Catalog WE-400 on "Tong Test" ammeter.

114. Contour Marker Corp.—Information on laying out pipe joints.

115. Coyne Cylinder Co.—Specification sheet and price list on acetylene cylinders.

116. Detroit Testing Machine Co.—Information on tensile testing.

117. Drawalloy Corp.—Sample of precision drawn fabricated wire for automatic and semiautomatic hardfacing.

118. Engwald Corp.—Application data on welding-fume exhausters.

119. General Electric Co.—Bulletin GEC-1333 on new 200-amp engine-drive welder.

120. Glenn Co.—Literature, application data, prices on water heaters.

121. Goldsmith Bros. Smelting & Refining Co.—Data book on low temperature silver brazing.

122. Harnischfeger Corp.—Information on new welding positioners.

123. Harrisburg Steel Corp.—Catalog on high-pressure gas cylinders.

124. Harris Calorific Co.—Descriptive Folder No. 540710 on "Super-Heat" torch.

125. Hewitt-Robins, Inc.—Bulletin No. H-4a on "Twin-Weld" hose.

126. Hobart Bros. Co.—Information on electric drive welders.

127. Hobart Bros. Co.—Details on transformer welders.

128. Hobart Bros. Co.—Information on gas-drive welders.

129. Hobart Bros. Co.—Information on 200 amp a-c welder.

130. Hobart Bros. Co.—Brochure on 200—"Husky Boy" welder.

131. Independent Engineering Co., Inc.—Information on package-type oxygen-nitrogen generating plants.

132. International Nickel Co., Inc.—Folder on repairing cast iron.

133. Invincible Vacuum Cleaner Mfg. Co.—Folder on flux recovery systems.

134. K-G Equipment Co., Inc.—Bulletin on new regulator gage-guard.

135. Kasson Die & Motor Corp.—Folder and details on portable arc welder with first torodial transformer.

136. Mallory & Co., Inc., P. R.—Resistance-welding catalog.

137. Metal Bond Mfg. Co.—Catalog on soldering and welding products.

138. Metal & Thermit Corp.—Catalog on accessories (from connectors to ovens).

139. National Cylinder Gas Co.—Literature on operating ease, performance, costs, of "Sureweld" welders.

140. Norris-Thermador Corp.—Information on specifications on sizes of acetylene cylinders.

141. Oxo Welding Equipment Co.—Catalog on gas regulators.

142. Ruemelin Mfg. Co.—Fume Collector Bulletin No. 37E.

143. A. O. Smith Corp.—Descriptive catalog on "SW-12" and other electrodes.

144. A. O. Smith Corp.—Information on welding electrodes.

145. Smith Welding Equipment Corp.—Information on "Econoflo" regulators.

146. Stulz-Sickles Co.—Details and price list on bars for rebuilding tractor grousers.

147. Superior Air Products Co.—Catalog on installation, operation, and maintenance of oxygen plants.

148. Sylvania Electric Products, Inc.—Technical information on 2% thoriated tungsten electrodes.

149. Tempil Corp.—Information on sample pellets of temperature indicators.

150. Tillman & Co., John—Catalog lists welding gloves and garments.

151. Titan Metal Mfg. Co.—Folder describing welding rod composition and uses.

152. Tweco Products Co.—Catalog on aluminum welding cable.

153. United Wire & Supply Corp.—Booklet on brazing.

154. Unitek Corp.—Brochure on stored-energy welder for making precision resistance welds.

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